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Ethnobotanical study of medicinal plants of Sirjan in Kerman Province, Iran

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ABSTRACT

Ethnopharmacological relevance: From ancient time human beings have used different plants, animals and minerals to prevent and treat various diseases. In this respect, plants have been of particular importance. Ethnobotany is the science of reviewing how indigenous people and local tribes have used their regional plants for particular purposes such as treating diseases in the past. The information gathered from such studies can help to improve national health systems and even lead to the discovery of new medicines. Keeping this in mind, in this study a survey of Sirjan area ethnobotany was conducted during 2011–2012.

Materials and methods: At the beginning, thirteen local people were interviewed about their region's medicinal plants and their consumptions. These plants were collected and identified using identification keys. The data collected was analyzed using quantitative value indices F_{IC}, RFC and CI.

Result: Many plants collected have medicinal properties and have been used by local people to treat various ailments. Of these plants, nineteen families, 37 genera and 43 species belonged to medicinal plants. Among them, Lamiaceae with 8 species and *Malva* L. with 3 species were the largest medicinal plant families and genera, respectively. These plants are often used as decoction (28%) and as powder (21%). Also, the fruit of these plants are used most often. Besides being used as medicinal plants, they have other uses such as food, fuel, etc. *Malva sylvestris* has the largest value of relative frequency of citation and cultural importance indices. The most ailment categories have the highest level of informant agreement (mean $F_{IC}=0.92$).

Conclusion: Despite the semi-desert climate and lack of rich vegetation, many medicinal and economic plants are found in Sirjan region. Uncontrolled harvesting of the medicinal plants such as *Bunium persicum*, *Cuminum cyminum*, *Zataria multiflora* and *Satureja bachtiarica* in this region by local people has increased the risk of their extinction and calls for a restrict control over their protection by the authorities.

1. Introduction

Plants play several important roles in human life supplying basic needs such as food, clothing, medicine and housing. People from each region use a variety of useful plants in their surroundings. Information about the art of using herbs is a legacy passed from one generation to another. Studies dealing with the relationships between human and plants are placed in the field of science called Ethnobotany. Ethnobotany surveys include interviewing local people, use of the available data in the literature and the folklore of each region. Ethnobotany goal is to protect and to pass the valuable and useful plants traditional knowledge to future generations. Uncontrolled harvest of medicinal plants by local people has increased the risk of extinction of many species and subsequently the loss of local knowledge as how to use them.

Iran with 8000 plants species and 1727 endemic species, is one of the ten important sources of speciation in the world (Yousofi, 2007). Historical evidence proves the fact that Iran is the most ancient civilizations in using the medicinal plants (the first doctor practiced in the world was an Iranian named Sryta whose name has been mentioned in the book of Avesta, the most ancient scriptures of Zoroastrianism) (Zargari, 1989–1992). Ethnobotany surveys were conducted in the Turkmen region for the first time (Ghorbani, 2005) and more recently in other parts of the country (Ghollassi Mood, 2008; Dolatkhahi et al., 2010; Iranmanesh et al., 2010; Sharififar et al., 2010; Mardani-Nejad and Vazirpoor, 2012;

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Mosaddegh et al., 2012; Safa et al., 2013). Study of Kerman region medicinal plants was conducted by Saber-Amoli et al. (2004) who identified 285 species of such plants.

Although the present study is not the first ethnobotany survey in Sirjan area, there are gaps in ethnobotanical knowledge in this region. The aim of the present study is not only about the region's medicinal plants but also about other plant products such as dye, fuel source, food, and others. Keeping these background information in mind and to study further the other applications of plants, this study as a second Sirjan Ethnobotany survey was conducted from December 2011 to September 2012. According to the information gathered from local people, there have been more medicinal plants in Sirjan region which have been extinct due to drought and excessive harvesting and this study seems to be critical in identifying the useful plants and keeping their records for future checkups.

Sirjan is an important city in southwest of Kerman Province and is one of the pioneering cities in mining industry. According to the census taken in 2006 the population of Sirjan is 245,812 of which, 187,627 (76.33%) is urban and 57,276 (23.3%) is rural. Less than 0.5% of the population is nomadic people. The majority of Sirjanian speak in Farsi but there are a limited number of Turkish speaking tribes in some areas. Most of the rural populations are engaged in agriculture cultivating mainly pistachios, almond and cereals.

1.1. Sirjan geographical location

The city of Sirjan is located (29°27′6.87″N 55°40′53.17″E) in southeast of Iran with an area of 16,217 square kilometers and elevation of 1785 m above sea level (Fig. 1). Sirjan is located between the central and eastern Zagros mountain chains, the most important of which are Kuh-Panj, Chahar Gonbad, Kaviz and Khajui. Sirjan also includes lowland area such as Kaf-e Namak in the west and Ebrahimabad plain (the highest plain in Iran) in southeastern of the region. Tanguie and Hosseinabad are the most important rivers in the region.

1.2. Climate and flora of the area

The city of Sirjan has a semi-arid climate with dry and cold winter and hot and dry summer. The average annual temperature, average humidity and average rainfall in this city are about 25 °C, 36% and 144 mm, respectively. Rich vegetations occur only in limited areas which are mostly covered by shrubbery. Most of the region has saline soils and salt-tolerant and plants like Chenopodiaceae and Tamaricaceae are found in abundance. With the change in topography and altitude, other plants such as *Amygdalus scoparia* Spach, *Berberis integerrima*, *Pistacia atlantica* and *Ferula* spp. can be found. In terms of floristic, Sirjan is located in the Afghano-Anatolian Central Plateau which is a desert area and halophyte communities and sagebrushes are the dominant soil cover.

2. Materials and methods

2.1. Data collection

Fieldwork was conducted over the seven months period focusing on collecting ethnopharmacological information from local people about the medicinal plants in different parts of Sirjan. Local medicinal plants practitioners and other knowledgeable people of the region such as elderly people, shepherds, farmers, herbalists, and medicinal herb vendors were among the interviewees. A total

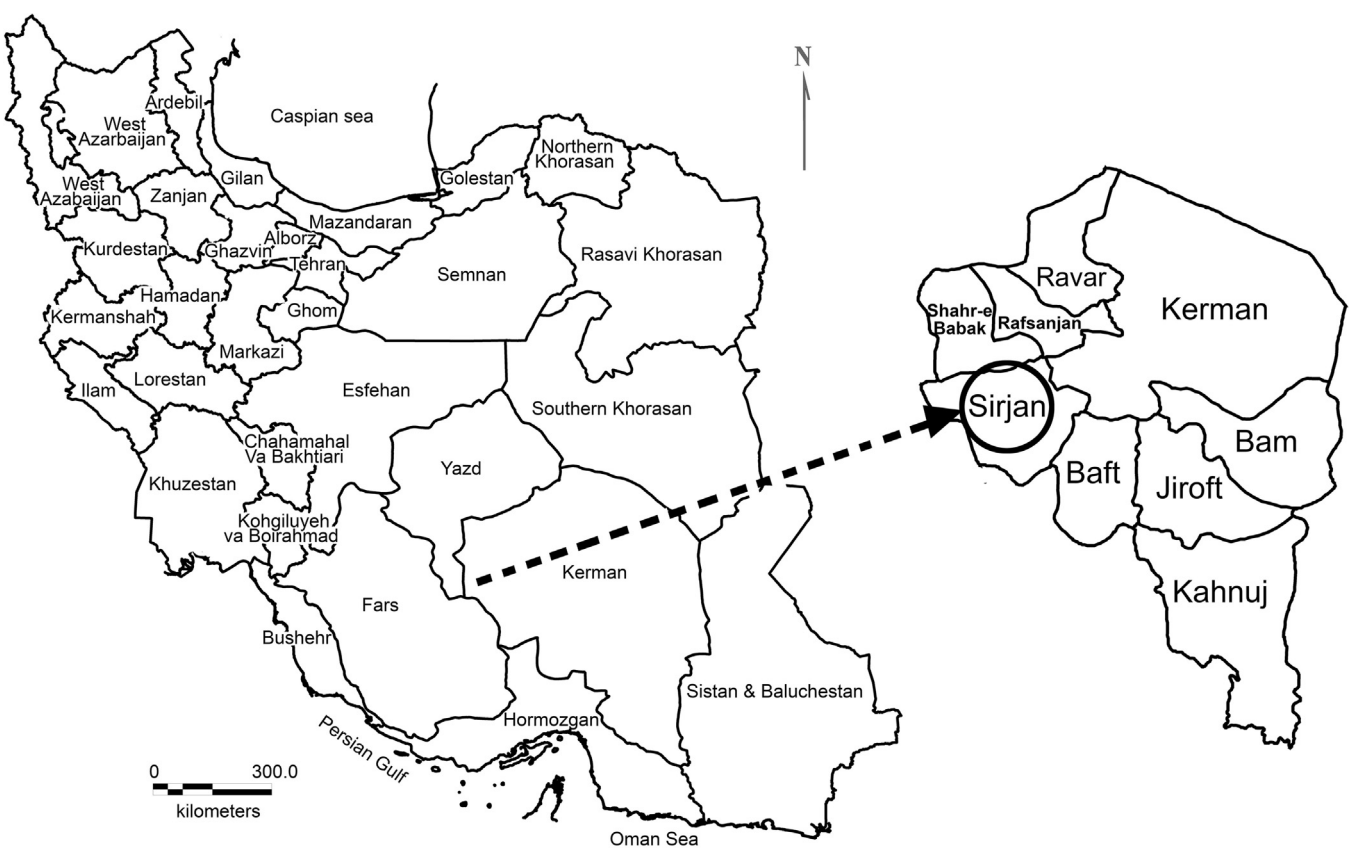

Fig. 1. Map of Iran showing Kerman Province and Sirjan district.

Table 1
Medicinal plant species of Sirjan district, Kerman Province.

No.	Family	Scientific name	Voucher number	Local name	Plant parts used	Medicinal uses	Preparation mode (s)	Other applications
(1)	Amarantaceae	*Amaranthus caudatus* L.	25003	Sorkh Maghz	Fruit, seed and flower	Neonatal jaundice, kidney stones	Cleaning up baby with flower extract, raw seeds	
(2)	Anacardiaceae	*Pistacia atlantica* Desf.	25004	Beneh	Fruit, seed/gum	Memory improvement	Raw fruit	Edible/animal feed/air freshener/ fuel/dyeing yarns
(3)	Apiaceae	*Anethum graveolens* L.	25005	Tokhm-e Shevid	Fruit	Menstrual cramps	Decoction	
(4)	Apiaceae	*Bunium persicum* B. Fedtsch.	25006	Zireh-e Siyah	Fruit	Digestive problems such as bloating and stomach ache	Aromatic water and powder	Edible
(5)	Apiaceae	*Cuminum cyminum* L.	25007	Zireh-e Sabz	Fruit	Abdominal pain and bloating, healing fractures and body aches	Decoction/powder/ a poultice	Edible
(6)	Apiaceae	*Foeniculum vulgare* Mill	25008	Badioon	Fruit	Abdominal pain and bloating	Powder	Edible
(7)	Apiaceae	*Trachyspermum copticom* L.	25009	Keserk	Fruit	Stomach ache	Aromatic water	
(8)	Asteraceae	*Achillea wilhelmsii* K. Koch	25010	Boomaderun	Leaves and flower	Body aches, stomach ache and bellyache	Aromatic water/ powder leaves and fruits, poultice	
(9)	Asteraceae	*Artemisia aucheri* Boiss.	25011	Jaz	Leaf	Abdominal pain	Leaf powder	Animal feed
(10)	Asteraceae	*Artemisia sieberi* Besser	25012	Jaz	Leaf	Abdominal pain	Leaf powder	Animal feed
(11)	Asteraceae	*Carthamus tinctorius* L.	25013	Gol-e Khezr	Flower	The plant has a cooling nature	In baking	Edible/dyeing yarns
(12)	Asteraceae	*Matricaria aurea* (Loefl.) Sch. Bip.	25014	Babooneh	Leaves and flower	Insomnia and nervous disorders (sedatives), menstrual pain, kidney ache	Infusion	Edible, hair color
(13)	Berberidaceae	*Berberis integerrima* Bunge	25015	Zarch	Fruit	Hypertension and abdominal ache	Fruit extract/fruit raw	Edible/used rennet for cheese production
(14)	Brassicaceae	*Descurainia sophia* (L.) Webb ex Prantl	25016	Khakshir	Seed	Diarrhea and abdominal pain, sore throat	Syrup/decoction	Edible
(15)	Capparidaceae	*Capparis spinosa* L.	25017	Dahak	Fruit and flower	Joint pain such as back pain and leg	Boiled fruit and flower	Edible
(16)	Elaegnaceae	*Elaeagnus angustifolia* L.	25018	Senjed, Senjet	Fruit	Osteoporosis, stomach ache	Raw fruit/powder fruit endocarp	Edible/livestock forage
(17)	Ephedraceae	*Ephedra major* Host	25019	Hoom	The aerial parts	Stomach ache	Decoction	
(18)	Fabaceae	*Alhagi pseudalhagi* (M. Bieb.) Desv. ex B. Keller and Shap	25020	Adoor, Khar-e Eshter	The aerial parts	Kidney stones	Aromatic water	
(19)	Fabaceae	*Glycyrrhiza glabra* L.	25021	Risheh-e Mak	Roots, stems ascending	Treat colds, stomach pain, joint pain (back and leg), bone fractures	Decoction	
(20)	Fabaceae	*Medicago sativa* L.	25022	Yonjeh	Leaf	Strengthening children, weight gain	Steamed/orally/ aromatic water	Edible/livestock forage
(21)	Fabaceae	*Trigonella foenum-graecum* L.	25023	Tokhm-e Shanbelileh	Fruit	Menstrual cramps	Decoction	
(22)	Fumariaceae	*Fumaria indica* Pugsley	25024	Shatereh	Fruit/the aerial parts	Abdominal pain	Decoction/aromatic water	Edible
(23)	Fumariaceae	*Fumaria parviflora* Lam.	25025	Shatereh	Fruit/the aerial parts	Abdominal pain	Decoction/aromatic water	Edible
(24)	Juglandaceae	*Juglans regia* L.	25026	Gerdoo	Leaves, seed, root	Diabetes and blanch teeth	Aromatic water and powder	Edible/hair color and dyeing yarn
(25)	Lamiaceae	*Acinos graveolens* Link	25027	Kakoti	Leaves and flower	Abdominal pain	Decoction/aromatic water/powder	Edible
(26)	Lamiaceae	*Lallemantia royleana* (Benth.) Benth.	25028	Marvereshk	Fruit	Cold and sore throat	Decoction/syrup	Edible
(27)	Lamiaceae	*Mentha longifolia* (L.) Huds.	25029	Pedeneh	Leaf	Abdominal pain	Aromatic water/ powder	Edible
(28)	Lamiaceae	*Satureja bachtiarica* Bunge	25030	Alaleh	Leaf	Flatulence	Infusion	Edible
(29)	Lamiaceae	*Teucrium polium* L.	25031	Kalpooreh	Flower	Chicken pox, ear infections and ear pain, abdominal ache, diarrhea in infants, acne and skin blemishes	Flower extract/ smoke from burnt flowers	
(30)	Lamiaceae	*Zataria multiflora* Boiss.	25032	Avishan	Leaves and flower	Constipation, stomach pain and menstrual cramps	Decoction/aromatic water/powder	Edible

Table 1 (*continued*)

No.	Family	Scientific name	Voucher number	Local name	Plant parts used	Medicinal uses	Preparation mode (s)	Other applications
(31)	Lamiaceae	*Ziziphora persica* Bunge	25033	Kakoti	Leaves and flower	Abdominal pain	Infusion/aromatic water /powder	Edible
32)	Lamiaceae	*Ziziphora tenuior* L.	25034	Kakoti	Leaves and flower	Abdominal pain	Infusion/aromatic water/powder	Edible
(33)	Malvaceae	*Alcea* sp.	25035	Khatmi-e Sefid	Flower	Cold	Decoction	
(34)	Malvaceae	*Malva nicaensis* Boiss.	25036	Penirak	Fruit	Cold and sore throat	Decoction	
(35)	Malvaceae	*Malva parviflora* L.	25037	Penirak	Fruit	Cold and sore throat	Decoction	
(36)	Malvaceae	*Malva sylvestris* L.	25038	Khatmi	Fruits and flower	Hypertension, with a cool nature, sore throat, refrigerant, acne and mouth disease, cold	Syrup, decoction, cleaning up with its powder	Edible
(37)	Myrtaceae	*Myrtus commonis* L.	25039	Moord Daneh	Fruit	Cold	Decoction/powder	Edible
(38)	Plantaginaceae	*Plantago lanceolata* L.	25040	Kouchak	Seed and leaves	Headaches and cold	Leaf poultice – fruit in cold boiled seed	
(39)	Plantaginaceae	*Plantago major* L.	25041	Tang-e bar	Seed	Constipation, cold and cough, strengthening babies	Decoction	
(40)	Punicaceae	*Punica granatum* L.	25042	Anar,Nar-e Farsi	Fruit , seed and flower	Skin blisters, skin tissue integrity, diarrhea in children, hypertension, strengthening and bleeding the gums	Poultice/powder/ decoction	Edible/dyeing yarns
(41)	Solanaceae	*Solanum nigrum* L.	25043	Revarizeh	Fruit	Improve toothache, gastrointestinal parasites	Raw, decoction	Edible
(42)	Zygophyllaceae	*Peganum harmala* L.	25044	Dashti	Fruit	Malaria fever and antiseptic air	Raw fruits/smoke	Air freshener
(43)	Zygophyllaceae	*Tribulus terrestris* L.	25045	Khar-Khorsak	Fruit	Kidney stones	Decoction	

of 13 informants (5 men and 8 women) aged between 45 and 87 who were cooperating fully were interviewed. The aim of this study has been explained for selected informants. Therefore, by understanding the importance of such a project, they themselves were satisfied to give information about medicinal plants. Interview was conducted using semi-structured questionnaires and open-ended conversations at homes or at medicinal plants stores. The vegetation of the area, plants pharmaceutical properties, methods of their preparation and the kind of ailments being used for, were among the questions asked. All the information gathered was recorded in the database.

2.2. Collection and identification

A team consisting of at least two local people and a botanist (the first author) collected plants from their habitats. Plants species in the flowering, fruiting stages or both were collected for identification. Collection started from late April till late July 2012. Plants were collected from Darestan village, Char Gonbad mountain, Kuh-Panj mountain, Hosseinabad village and Khajuei mountain regions. The elevations and geographical coordinates of the collection sites were recorded. Collected plants were dried and pressed as herbarium specimens and were deposited at Shiraz University herbarium for identification. Plants were identified to species level using Flora of Iran (Assadi, 1988–2010) and Flora Iranica (Rechinger, 1965–2008). Voucher specimens were labeled and were kept in the herbarium of Shiraz University.

2.3. Data analysis

The data collected was analyzed using quantitative value indices, F_{IC}, RFC and CI, which are the most popular indices in quantitative ethnobotany based on "informant consensus" (Albuquerque and Lucena, 2005). One of the measured indices used here is F_{IC} (informant consensus factor) which is calculated by the following formula (Trotter and Logan, 1986):

$$F_{IC} = N_{ur} - N_t/(N_t - 1)$$

where N_{ur} is the number of use-reports of informants for a particular illness category and N_t refers to the number of species used for the illness category by all informants. F_{IC} values range from 0 to 1. A value close to one indicates a high intracultural consensus (i.e. most informants use the same species for treatment of the same illnesses) (Heinrich et al., 1998). A value close to zero indicates a high variation in the use of species (i.e. informants disagree over which species to use in the treatment within a category of illness.)

Another index used here is the relative frequency of citation (RFC). This index is obtained by dividing the number of informants mentioning a useful species (FC or frequency of citation), by the total number of informants in the survey (N). RFC value varies from 0 (when nobody refers to a plant as a useful one), to 1 (when all the informants mentioning it as useful) (Tardio and Pardo-de Santayana, 2008). RFC index, which does not consider the use-category (UR or use-report is a single record for use of a plant mentioned by an individual) and RFC calculated by the following formula:

$$\mathrm{RFC_s} = \frac{\mathrm{FC_s}}{N} = \frac{\Sigma_{i=i_1}^{i_N} \mathrm{UR_i}}{N}$$

The third approach used in our study is the cultural importance index (CI) (Tardio and Pardo-de Santayana, 2008). This index is calculated by the sum of the proportion of informants mentioning each species use (i.e. the sum of the number of participants who mention the use of each species divided by the total number of informants (N)). This index is calculated by the following formula:

$$\mathrm{CI}i = \sum_{u=u1}^{uNC} \sum_{i=i1}^{iN} \mathrm{URui}/N$$

This index takes into account the spread of the use (number of informants) for each species along with its versatility, i.e. the diversity of its applications (Tardio and Pardo-de Santayana, 2008).

3. Results and discussion

In this study a total of nineteen families, 37 genera and 43 species with medicinal properties were collected from Sirjan region. Information about the local names of the plants, their uses and parts of the plants used for their medicinal effects are listed in Table 1 in alphabetical order. Lamiaceae with 8 species and *Malva* L. with 3 species are the largest medicinal plants family and genera (Fig. 2). In a similar study in Tehsil Birmal of Pakistan, Lamiaceae and Asteraceae, the highest number of medicinal plants species are used by local people (Farooq et al., 2012). Dicotyledonous flowering plants (98%) were the widely used plants for medicinal treatment among the local people. Eighty one percent (81%) of the plants are wild and 19% are implants.

Results showed that the most common parts of the plants used are their fruits (36%) (Fig. 3). Majority (91%) of the plants are used in dried state with fresh plants being less favored. Plants are often used as decoction (28%) and as powder (21%). A small proportion is also used as steamed plants.

Plants species are used in the treatment of gastrointestinal diseases (45%) and respiratory ailments (16%). Fifty-two percent of plants like *Teucrium polium*, *Malva sylvestris*, *Glycyrrhiza glabra* and *Matricaria aurea* have more than one pharmaceutical properties.

The results of this study showed that Lamiaceae is the largest medicinal plant family been used by local Sirjanian people as by other people in the Iranian plateau (Dolatkhahi et al., 2010; Mardani-Nejad and Vazirpoor, 2012; Sher and Hussain, 2009). Lamiaceae with 46 genera, 410 species and 124 endemic species is one of the largest plant families in Iran and in the world and many of its members are used as herbal medicine, especially for the treatment of gastrointestinal diseases (Naghibi et al., 2005). The fruit of these plants are the most commonly used plants parts in these areas. However, many ethnobotanical studies conducted elsewhere in the Iranian plateau showed the dominane of leaves in the preparation of medicine (Ghorbani, 2005; Mosaddegh et al., 2012; Ullah et al., 2013; Saqib et al., 2014; Sadeghi et al., 2014).

3.1. Use reports and use cataegories

A total of 584 use reports have been documented in this survey which are categorized in eleven different illness groups. These include, digestive system disorders (44.61%) which is the highest number of records (Fig. 4). Ethnopharmaecological studies have shown that in some parts of the world, the gastrointestinal system disorder is the first use category (Heinrich et al., 1998; Miraldi et al., 2001; Ghorbani, 2005; Ghorbani et al., 2011; Mosaddegh et al., 2012). Due to poor dietary conditions and unsafe drinking water, this ailment is one of the most common problems in the areas studied and in fact in other parts of the world. People of these areas believe that the best plant for the treatment of stomach ache is thyme (*Zataria multiflora*).

Respiratory diseases such as common cold and sore throat are other prevalent ailments in these regions that are treated with medicinal plants by local inhabitants. In a similar study conducted in Wana district in Pakistan, the use of medicinal plants for the treatment of gastrointestinal disorders had a high prevalence (Ullah et al., 2013). Semi-arid climate, inadequate moisture and water deficit are the reasons of disease outbreaks in Sirjan and Wana. Thus, the local people of Sirjan and Wana considered plants as a good source for diseases treatment especially gastrointestinal diseases and colds.

3.2. Comparing different indices

Comparing the quantitative indices used in ethnobotanical studies will help the better understanding of the traditional knowledge of plants used by local people in one area. As shown in Tables 2, 18.44% (about 19 species) of the species studied have relative frequency of citation one (RFC = 1). It means these species are the most popular medicinal plants agreed by the majority of

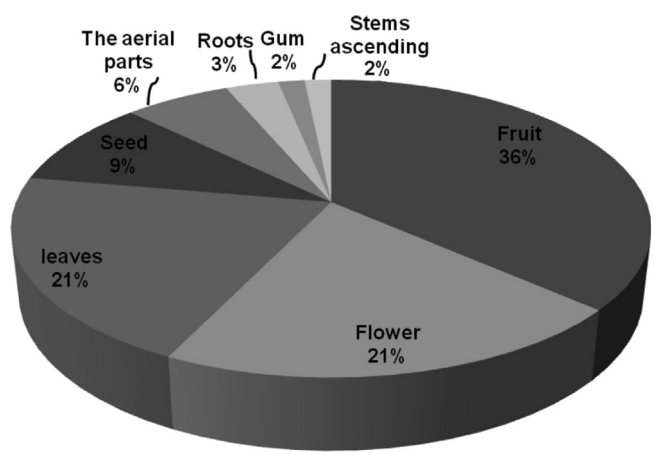

Fig. 3. Percentage of plant parts used.

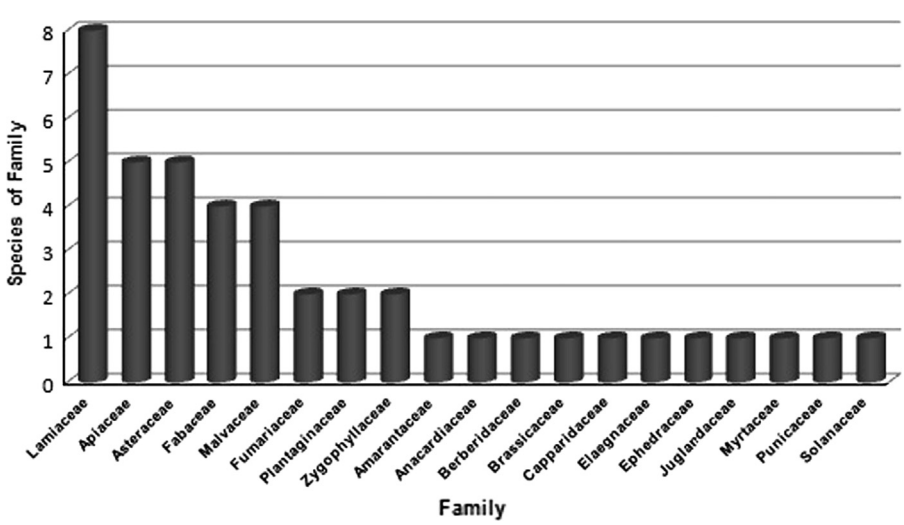

Fig. 2. The number of medicinal species in each family.

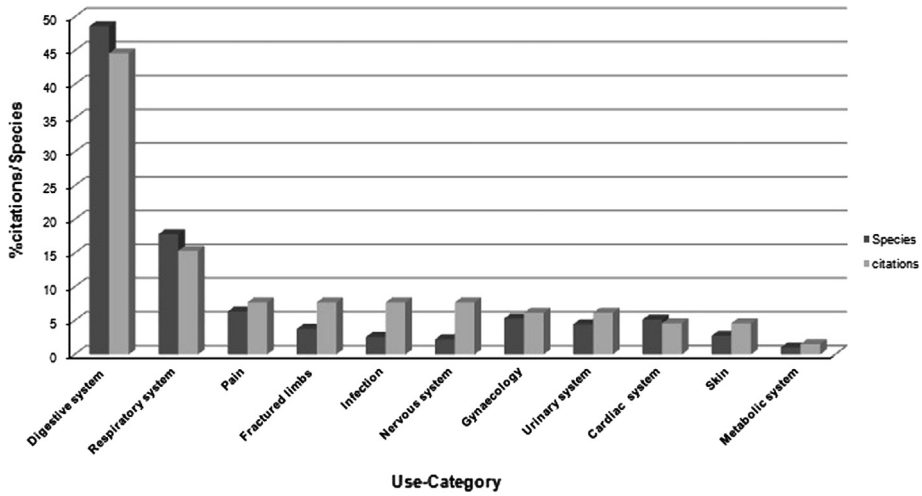

Fig. 4. Percentage of species and citations in each medicinal use category.

Table 2
Comparison of important plants by using indices and species ranking based on each index.

Scientific name	FC	UR	NU	RFC	CI	RFC ranking	CI ranking
Malva sylvestris L.	13	41	4	1	3.307	1	1
Glycyrrhiza glabra L.	13	37	3	1	2.923	1	2
Punica granatum L.	13	30	3	1	2.307	1	3
Cuminum cyminum L.	13	28	3	1	2.153	1	4
Descurainia sophia (L.) Webb ex Prantl	13	24	2	1	1.846	1	5
Plantago major L.	12	24	2	0.923	1.846	2	5
Teucrium polium L.	11	24	3	0.846	1.845	3	6
Matricaria aurea (Loefl.) Sch. Bip.	10	23	3	0.769	1.768	4	7
Zataria multiflora Boiss.	13	20	2	1	1.538	1	8
Achillea wilhelmsii K. Koch	11	20	2	0.846	1.538	3	8
Amaranthus caudatus L.	13	15	2	1	1.153	1	9
Foeniculum vulgare Mill	13	13	1	1	1	1	10
Capparis spinosa L.	13	13	1	1	1	1	10
Trachyspermum copticom L.	13	13	1	1	1	1	10
Satureja bachtiarica Bunge	13	12	1	1	0.923	1	11
Mentha longifolia (L.) Huds.	13	12	1	1	0.923	1	11
Acinos graveolens Link	12	12	1	0.923	0.923	2	11
Ziziphora persica Bunge	12	12	1	0.923	0.923	2	11
Ziziphora tenuior	12	12	1	0.923	0.923	2	11
Lallemantia royleana (Benth.) Benth.	12	12	1	0.923	0.923	2	11
Solanum nigrum L.	12	12	1	0.923	0.923	2	11
Berberis integerrima Bunge	9	12	2	0.692	0.922	5	11
Bunium persicum B. Fedtsch.	13	11	1	1	0.846	1	12
Alhagi pseudalhagi (M. Bieb.) Desv. ex B. Keller and Shap	11	11	1	0.846	0.846	3	12
Malva nicaensis Boiss.	11	11	1	0.846	0.846	3	12
Malva parviflora L.	11	11	1	0.846	0.846	3	12
Plantago lanceolata L.	9	11	2	0.692	0.845	5	13
Elaeagnus angustifolia L.	12	16	2	0.923	0.815	2	14
Myrtus commonis L.	10	10	1	0.769	0.769	4	15
Trigonella foenum-graecum L.	8	8	1	0.692	0.692	5	16
Juglans regia L.	13	9	2	1	0.691	1	17
Medicago sativa L.	13	8	1	1	0.615	1	18
Carthamus tinctorius L.	8	8	1	0.615	0.615	6	18
Ephedra major Host.	8	8	1	0.615	0.615	6	18
Anethum graveolens L.	8	8	1	0.615	0.615	6	18
Artemisia aucheri Boiss.	11	7	1	0.846	0.538	3	19
Artemisia sieberi Besser	11	7	1	0.846	0.538	3	19
Fumaria indica Pugsley	13	6	1	1	0.461	1	20
Fumaria parviflora Lam.	13	6	1	1	0.461	1	20
Tribulus terrestris L.	6	6	1	0.461	0.461	7	20
Peganum harmala L.	13	4	1	1	0.307	1	21
Alcea sp.	4	4	1	0.307	0.307	8	21
Pistacia atlantica Desf.	13	3	1	1	0.23	1	22

F_{IC} frequency of citation; UR, use reports and NU, number of uses.

the informants and they are the most popular plants in Sirjan (Fig. 5). *Alcea* sp. and *Tribulus terrestris* have the lowest number of citations and thus a few number of informants believed that these are useful species (Table 2).

Malva sylvestris has the highest number of use-reports (41 UR) in our study, followed by *Glycyrrhiza glabra* and *Punica granatum* with 37 and 30 use-report, respectively, and are placed in the next positions (Fig. 6).

A comparison between the RFC and the CI indices is shown in Table 2. *Malva sylvestris* is placed in the first position by RFC and CI indices. This means that this species has been mentioned by all informants and is the most recognized plant in the region. Also, because of the highest values of CI index, this species has the most diverse uses. *Glycyrrhiza glabra*, *Punica granatum* and *Cuminum cyminum* which were ranked first by RFC index, were ranked 2nd, 3rd and 4th by CI index, respectively.

Table 3 shows the informant consensus factor)F_{IC}(for eleven use categories. The most ailment categories have both the highest level of informant agreement (mean $F_{IC}=0.92$) and the total consensus ($F_{IC}=1.00$) obtained for metabolic disorder. In an ethnobotanical study of Rasuwa District in Central Nepal, similar to our study, informants had the highest level of agreement for most of the ailment categories (mean $F_{IC}=0.82$) (Uprety et al., 2010). These results obtained by F_{IC} index do not agree with those reported for ethnobotanical study in Kohghiluyeh and Boyer Ahmad Province in Iran and also for Hani ethnicity in China (Ghorbani et al., 2011). This shows the persistent use of traditional medicinal plants by local people in one part of Iran similar to Saravan region (Sadeghi et al., 2014). This points to the fact that although the local people have access to government health care system, still medicinal plants have not lost their values among the people living. Also, high F_{IC} values can be used to pinpoint interesting species in search of bioactive compounds (Canales et al., 2005).

3.3. Plants that are used in combination

Local people believe that for the best treatment of certain diseases, some medicinal plants should be used in combination with others. For example, the combination of three plants *Plantago lanceolata*, *Malva sylvestris* and *Lallemantia royleana* is useful in treating common cold. Also *Lowsonia inermis* when mixed with *Punica granatum* powdered fruit exocarp is effective in treating dermal blisters. Fumes from burning *Descurainia sophia* seeds

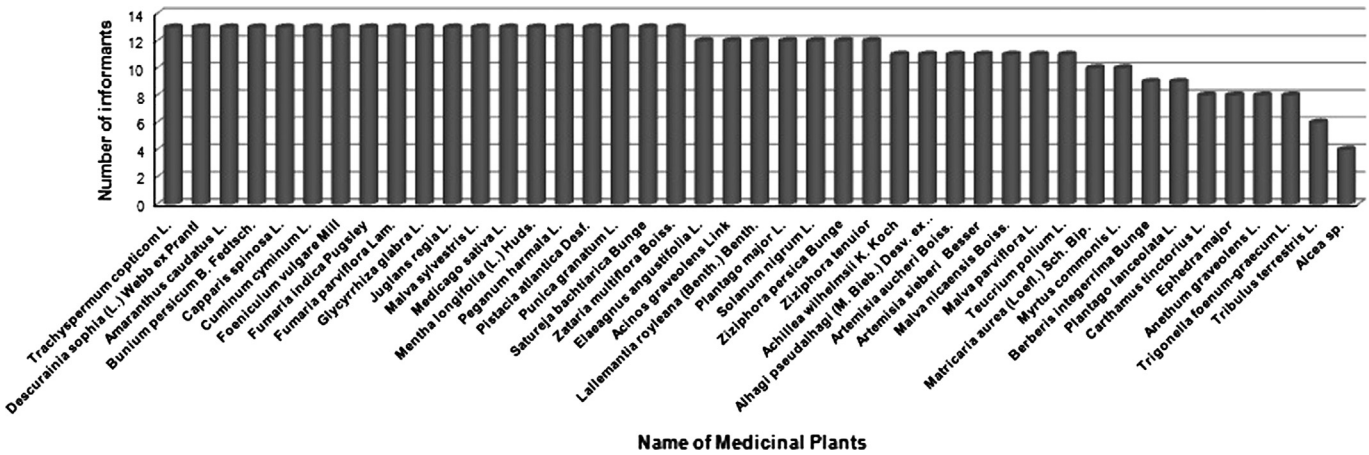

Fig. 5. Species with the highest number of informants.

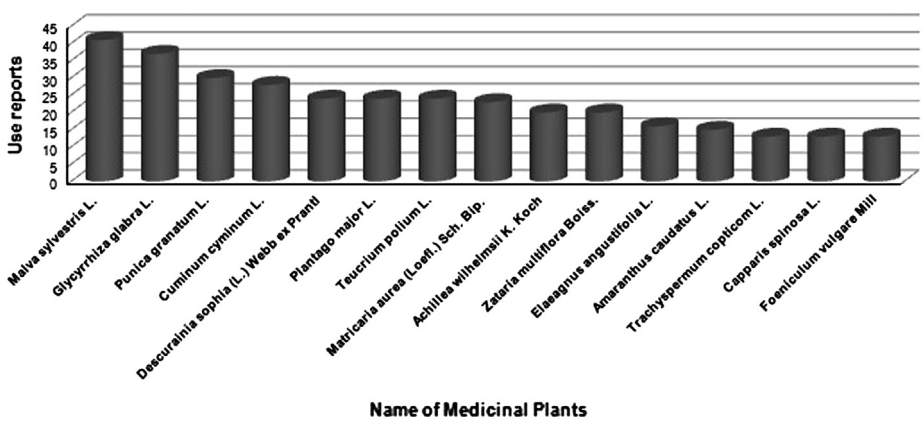

Fig. 6. Species with the highest number of use-reports.

Table 3
Informant agreement factor for different use categories.

Use-category	N_t	N_{ur}	F_{IC}
Metabolic disorder	1	6	1
Fractured limbs	2	22	0.952
Cardiac system	3	30	0.931
Infection	2	15	0.928
Nervous system	2	13	0.916
Respiratory system	10	104	0.912
Digestive system	29	284	0.901
Gynecology	4	31	0.9
Pain	5	37	0.888
Urinary system	4	26	0.88
Skin	3	16	0.86

N_t, number of taxa; N_{ur}, number of citations in each use category. IAR: informant agreement ratio.

combined with *Teucrium polium* flowers heal ear aches and ear infections. Flatulence is treated with the mixture of the dried fruits of *Bunium persicum* B. Fedtsch., *Anethum graveolens* and *Cuminum cyminum*.

One of the popular foods in Kerman Province and Sirjan is called "Qovatoo" which is prepared by a mixture of fruits and seeds powder of 19 plants such as *Hordeum vulgare* L., *Helianthus annuus* L., *Lactuca sativa* L., *Corchorus capsularis* L., *Sesamum indicum* L., *Pistacia vera* L., *Nigella arvensis*, *Linum usitatissimum* L., *Amygdalus commmunis* L., *Myrtus commonis* and *Coriandrum sativum*. Local people believe that it will increase male potency and improves intelligence and memory.

3.4. Plants with multiple names

Two species of *Ziziphora* L. and *Acinos graveolens* due to their similarities in smell are known as a Kakuti. *Achillea wilhelmsii* in their pre-flowering stages are known as deleted Movr-Potoo (local name) and in flowering stage are known as Boomaderun.

Local people often identify plants by a few morphological characters. Thus, some related species of a genus may be referred to as the same plant. Two species of *Artemisia* are known as "Jaz" and two species of *Fumaria* L. are known as "Shatareh".

3.5. Other applications of medicinal plants

As mentioned before, other applications of plants with medicinal properties were also recorded in our study and most of these plants are used as human food (48%) (Table 1).

3.5.1. Edible plants

Edible plants such as *Capparis spinosa* are highly desirable in these regions. According to their growing season they are harvested by people and even sold in local markets. Edible plants are used as fresh vegetables for the preparation of different foods and pickles. Some examples of these plants with local names are: *Mentha longifolia* (Pedeneh), is used as a vegetable. *Medicago sativa* (Yonjeh) used cooked (a local soup named Omach) and *Pistacia atlantica* in the preparation of pickles (Table 1).

3.5.2. Economic plants

In the past, *Pistacia atlantica* was used as a fuel source. *Medicago sativa*, *Elaeagnus angustifolia* (Senjed), *Artemisia aucheri* (Jaz) and *Artemisia sieberi* (Jaz) are used as forage. Eight species (15%) of the 43 medicinal species listed in Table 1 are used in field of technology and craft. Iranian women are famous for weaving Gilim (a kind of carpet) which has yarns with natural dyes prepared from different plant types such as *Punica granatum* (Anar), *Juglans regia* (Gerdoo) and *Carthamus tinctorius* (Gol-e Khezr). These handicrafts are exported all over the world and are very good sources of income for weavers. *Peganum harmala* (Dashti) and *Pistacia atlantica* are good air fresheners and *Berberis integerrima* (Zarch) is used in cheese production (Table 1).

3.6. Plants known in other parts of Iran

Tribulus terresteris, *Mentha longifolia*, *Malva parviflora*, *Ziziphora tenuir*, *Glycyrrhiza glabra*, *Capparis spinosa* and *Achillea wilhelmsii* are used as the same traditional medicine as in Sirjan and Hormozgan Province (Safa et al., 2013(. *Zataria multiflora* is a plant of Lamiaceae family which is used to treat stomach ache in Sirjan and Kohghiluyeh and Boyer Ahmad Province. *Punica granatum* is a medicinal plant in Sirjan which is used in the treatment of diarrhea as well as in Turkmen Sahra (Ghorbani, 2005).

4. Concluding remarks

Despite the semi-desert region, poor vegetation, low species richness and the lack of any vegetation in some areas, such as in salt desert, forty three plant species belonging to thirty seven genera from nineteen families in Sirjan were identified that represent relatively well the plant diversities in this district. The data analysis for this study using quantitative indices shows that medicinal plants are an integral part of life of Sirjanian people. Plants play very strong roles in different aspects of Sirjanian's lives, such as in local game (Tark-e bazi) with willow branches in the celebrations or in childrens games for making toy guns with leaves of *Alhagi pseudalhagi* and or for washing hands with flowers of *Prosopis farcta* (Sol. ex Russell) J.F. Macbr. which makes a good detergent. Medicinal plants like thyme and caraway are important sources of income for rural Sirjan people.

Similar to other parts of the world, there are erroneous common beliefs about plants in Sirjan too. For example, some people believe that anyone who watches the fruits of the fennel plant, should eat a few of its seed, otherwise his brother will die. Identifying the present species and endemic or endangered species plants in the region in order to protect them is an important issue that should be addressed in the future. Unauthorized harvesting of the plants such as *Bunium persicum*, *Cuminum cyminum*, *Zataria multiflora* and *Satureja bachtiarica* in this region by local people has increased the risk of extinction of many species and so it is necessary to protect this area in order to prevent their extinction. An ethnobotany study that may lead to the discovery of new drugs is recommended for all parts of Iran.

Since ethnobotany studies are time consuming, it is recommended that this subject be included in students curriculum to help them learn more and be familiar with the plants growing in their regions and the roles they play in their lives. In this discipline, large amount of information about the flora of each area will enter the database in a short time and is prevented from being forgotten and distorted.

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