

Review Article

Ethnobotanical knowledge of Apiaceae family in Iran: A review

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Abstract

Objective: Apiaceae (Umbelliferae) family is one of the biggest plant families on the earth. Iran has a huge diversity of Apiaceae members. This family possesses a range of compounds that have many biological activities. The members of this family are well known as vegetables, culinary and medicinal plants. Here, we present a review of ethnobotanical uses of Apiaceae plants by the Iranian people in order to provide a comprehensive documentation for future investigations.

Materials and Methods: We checked scientific studies published in books and journals in various electronic databases (Medline, PubMed, Science Direct, Scopus and Google Scholar websites) from 1937 to 2015 and reviewed a total of 52 publications that provided information about different applications of these plant species in human and livestock.

Results: As a result of this review, several ethnobotanical usages of 70 taxa, 17 of which were endemic, have been determined. These plants were used for medicinal and non-medicinal purposes. The most commonly used parts were fruits, leaves, aerial parts and gums. The most common methods of preparation were decoction, infusion and poultice.

Conclusion: To our knowledge, this paper represents a comprehensive literature search of ethnobotanical uses of Apiaceae reported from Iran. This study highlights the rich traditional knowledge of this family that has remained in Iran. However, most of this knowledge survive only as memories from the past in the minds of the elderly, and will probably vanish in a few decades. Thus, we compiled these scattered data together in a single document for the next scientific works with ethnobotanical interests.

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Introduction

The Apiaceae (previously known as the Umbel Family: Umbelliferae) is one of the largest plant families in the world. This

family comprises approximately 450 genera and 3700 species worldwide (Pimenov and Leonov, 1993). The members of this family are well known as

vegetables, culinary and medicinal plants such as *Anethum graveolens* (dill), *Anthriscus cerefolium* (chervil), *Angelica spp.* (angelica), *Apium graveolence* (celery), *Carum carvi* (caraway), *Coriandrum sativum* (coriander), *Cuminum cyminum* (cumin), *Foeniculum vulgare* (fennel), *Ferula gummosa* (galbanum), and *Pimpinella anisum* (anise), etc. Plants of this family usually possess a characteristic pungent or aromatic smell which is owing to the presence of essential oil or oleoresin (Singh and Jain, 2007). Members of Apiaceae possess various compounds with many biological activities. Some of the main properties are ability to induce apoptosis, antibacterial, hepatoprotective, vaso-relaxant, cyclooxygenase inhibitory and antitumor activities (Pae et al., 2002). For the family Apiaceae, Iran is a major center of diversification. In Iran, the Apiaceae family is represented by 121 genera and 360 species. Iran with unique climatic conditions has a large variety of plants, especially some unique endemic plants. From the endemism points of view, Apiaceae is an important family in the flora of Iran with 122 endemic taxa (Mozaffarian, 2007; Emami and Aghazari, 2011). Iran has a very honorable history in folk medicine, which dates back to the time of Babylonian-Assyrian civilization. One of the most significant ancient heritages is knowledge of people who tried over the millennia to discover useful plants for health improvement and each generation added their own experience to this tradition (Naghbi et al., 2005). Iran has a long history of medical practice and knowledge of plant remedies. The documentation of traditions of plant use in Iran was begun many years ago (Hopper and Field, 1937). Recently, several local ethnobotanical studies focusing on different parts of Iran have been published (Amin, 1992; Zargari, 1996; Ghorbani, 2005; Ahvazi et al., 2012; Amiri et al., 2012; Emami et al., 2012; Mosaddegh et al., 2012; Rajaei et al., 2012; Amiri and Joharchi, 2013; Safa et al., 2013;

Dolatkhahi and Nabipour, 2014; Sadeghi et al., 2014; Sharififar et al., 2014; Tahvilian et al., 2014; khodayari et al., 2015). However, there are no distinct references on the ethnobotanical applications of this family in Iran and most of the publications and documents are scattered. Thus, we compiled these scattered data together in a single document for the next scientific works with ethnobotanical interests. In addition, we reported information on conservation and endemism status of some of these taxa in Iran.

Methods

We checked scientific studies in various electronic databases (Medline, Pubmed, Science Direct, Scopus, and Google Scholar websites) from 1937 to 2015. After a comprehensive search on the ethnobotanical aspects of Apiaceae family in Iran, we reviewed a total of 52 publications that provided information about different applications of these plant species in human and livestock. In this article, scientific and author names of plant species were checked for latest changes according to "The plant list" (<http://www.theplantlist.org>).

Results

In this review, ethnobotanical usages of 70 species, 17 of which were endemic, have been determined. Table 1 illustrates the results of this study. The plants used for various purposes in different parts of Iran were arranged in alphabetical order of their botanical names, with the relevant data. The information includes vernacular names, the part(s) used, the method of preparation, and medicinal and non-medicinal aspects along with literature sources. The species marked with an asterisk (*) were endemic species belonging to this family in Iran. The mostly used parts of the plants were fruits

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(21 species) followed by leaves (17 species), aerial parts (17 species), gum (13 species), root (12 species), stem (7 species), flowers (4 species), whole plant (4 species), seed (3 species) and rhizome (1 species) (Figure 1). The most common methods of preparation were decoction (20 species), followed by infusion (13 species), poultice (6 species), smoke (3 species), vapor (3 species), pill (2 species) and powder (2 species) (Figure 2).

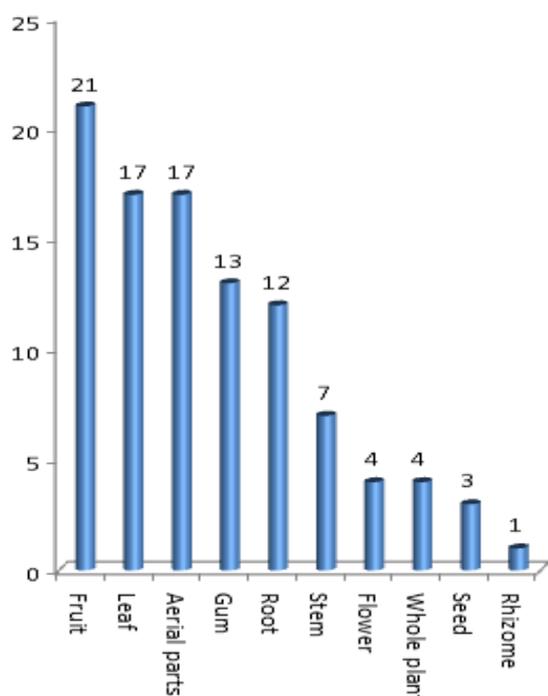


Figure 1. Proportional presentation of plant parts used.

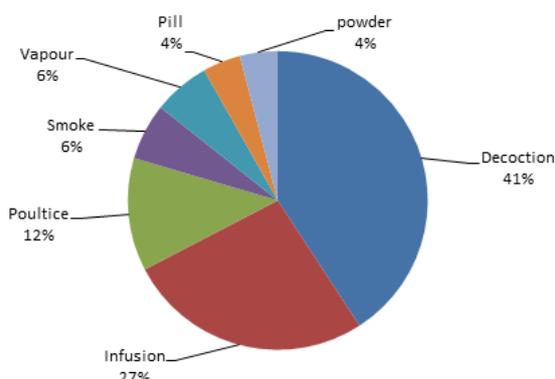


Figure 2. Mode of preparations and their percentages.

The importance of ethnobotanical aspects

Ethnobotanical investigations generally result in the documentation of a rather limited set of well-documented beneficial plants, mostly medicinal, but also those known to be poisonous or used in nourishment (Ghorbani et al., 2006). In this paper, the members of Apiaceae family were used for various purposes, however we categorized their uses into three main groups including: 1) medicinal plants used in human; 2) medicinal plants used in livestock and 3) non-medicinal aspects.

Medicinal plants used for humans

From a total of 70 species belonging to this family, 66 species were reported to be used for medicinal purposes in human. Among them, the most frequently quoted species in this category were: *Bunium persicum* (Boiss.) B.Fedtsch., *Cuminum cyminum* L., *Dorema aucheri* Boiss., *Dorema ammoniacum* D.Don, *Ducrosia anethifolia* (DC.) Boiss., *Ferula assafoetida* L., *Ferula gummosa* Boiss., *Ferulago angulata* (Schltdl.) Boiss., *Olivaria decumbens* Vent., *Prangos ferulacea* (L.) Lindl. and *Smyrniium cordifolium* Boiss. Most reported medicinal uses were for treatment of gastro-intestinal, respiratory system, urinary system, metabolic system, gynaecological and skin disorders, and also they were used as antiseptic, anthelmintic, calmative, antipyretic, galactagogue and appetizer agents.

Medicinal plants used for livestock

Ten species have been recorded to have medicinal uses in veterinary. Among them, the most commonly used plants were: *Carum carvi* L. fruits, which were consumed for ectoparasites, digestive troubles, skin diseases, fever and mouth infection in livestock. The fruits of *Cuminum cyminum* L. were used to increase libido in female camels and as an anti-bloat agent in cattle and sheeps. Gum and root of *Dorema ammoniacum* D.Don were used to treat infectious wound

infection and abscess in sheep and goat. Gum and root of *Dorema aucheri* Boiss. Were used for treatment of infectious wounds and infection in sheep. Aerial parts of *Oliveria decumbens* Vent. were used for treatment of diarrhea. Aerial parts and root of *Smyrniium cordifolium* Boiss. were used for treatment of urinary retention.

Plants with non-medicinal uses

From the 70 taxa recorded in this article, 30 species had both medicinal and non-medicinal applications. Apart from these, four species including *Astrodaucus orientalis* (L.) Drude, *Chaerophyllum macropodium* Boiss., *Froriepia subpinnata* (Ledeb.) Baill. and *Physospermum cornubiense* (L.) DC. had no medicinal effect and were only used for other purposes. In totally, thirty-four species have been reported for miscellaneous uses including edible, making pickles, as natural dyes and as flavors in salad, soup, etc. As stated in Table 1, the most cited species for edible uses were *Anethum graveolens* L., *Coriandrum sativum* L., *Cuminum cyminum* L., *Ferulago angulata* (Schltdl.) Boiss., *Foeniculum vulgare* Mill., *Heracleum persicum* Desf. ex Fisch., *Petroselinum crispum* (Mill.) Fuss, *Pimpinella anisum* L., *Prangos ferulacea* (L.) Lindl. and *Smyrniium cordifolium* Boiss. Many of these taxa were used all over the country. However, some other species, such as *Dorema aucheri* Boiss., *Kelussia odoratissima* Mozaff. and *Oliveria decumbens* Vent. were only used in a small area. Most of these taxa were used as wild vegetables. These species with much narrower distribution were exclusively used in Iran, and therefore could be considered as 'typical Iranian wild edibles'. It is sometimes hard to know whether a particular sample was wild or cultivated. For example, some species, such as *Kelussia odoratissima* Mozaff. were only native to certain parts of Iran, although they were cultivated in some

other regions of the country. Kelus or karafs-e-Bakhtyari (*Kelussia odoratissima* Mozaff.) was widely used as a wild vegetable and flavoring. It could be found in local markets and beside the roads by local people. Some species such as *Echinophora platyloba* DC., *Kelussia odoratissima* Mozaff. and *Levisticum officinale* W. D. Koch were used as a flavor in yoghurt. *Chaerophyllum macropodium* Boiss. was cooked and eaten with rice. *Ferula angulata* Schltdl. was added as a flavor to animal oil. The young leaves and branches of *Dorema aucheri* Boiss. were used for making a locally famous pickle called "Bilhar Pickle" and used as vegetable in a local soup. Non-edible uses have also been recorded. For instance, aerial parts of *Prangos ferulacea* (L.) Lindl. were used as a dye (yellow color).

Comments on some most cited species

Our results indicated that medicinal species such as *Bunium persicum* (Boiss.) B.Fedtsch., *Dorema ammoniacum* D.Don, *Ducrosia anethifolia* (DC.) Boiss., *Ferula assa-foetida* L., *Ferula gummosa* Boiss., *Oliveria decumbens* Vent., *Prangos ferulacea* (L.) Lindl. and *Smyrniium cordifolium* Boiss. were mentioned by many studies. Among Iranian people, the use of Zireh (Persian name) is very popular. According to Table 1, five kinds of Zireh including Zireh-e-Siah (*Bunium persicum* (Boiss.) B.Fedtsch.), Zireh-e-Shami (*Carum carvi* L.), Zireh-e-Sabz (*Cuminum cyminum* L.), Zireh-e-Sefid (*Cuminum setifolium* (Boiss.) Kos.-Pol.) and Zireh-e-vahshi (*Lagoecia cuminoides* L.) were used in Iran. The most remarkable one that has the highest number of reports was *Bunium persicum* (Boiss.) B.Fedtsch., which is also known as Zireh-e-koochi in Iran. In Iranian folk medicine, this species was applied as a galactagogue, carminative, calmativ, appetizer, decongestant agent and to treat indigestion, children earache, newly delivered ladies

recovery, cold-natured conditions and weaknesses. In addition, it was used as a flavor. The genus *Ferula* comprises about 170 species distributed from central Asia to northern Africa. It represented by 30 taxa, 20 of which are endemic to Iran. The popular Persian name for most of these species is “Koma” (Pimenov and Leonov, 1993; Emami and Aghazari, 2011; Mozaffarian, 2007). Most species of this genus have been used in traditional medicine. The most striking of them, with the highest number of citations were *Ferula assa-foetida* L. and *Ferula gummosa* Boiss. The most popular Persian names for *Ferula assa-foetida* L. were Anghuzeh, Heltit and Gane-bu. It was claimed to be highly effective on stomachache, cough, epilepsy, tremor and epilepsy and is used as an anthelmintic and antihemorrhoid agent and also in the treatment of gastritis. *Ferula gummosa* Boiss., commonly known as Barijeh or Ghasni, was used for liver cysts and dyspepsia, and as an anthelmintic, anticatarrhal, antiallergic, appetizer and emmenagogue agent. The genus *Dorema* is represented by 7 species in Iran, 2 of which are endemic. The most famous of them, with the highest number of citations were *Dorema ammoniacum* D.Don and *Dorema aucheri* Boiss. The most popular Persian names for *Dorema ammoniacum* D.Don were Kandal, Vasha and Ushegh. It was traditionally used for the treatment of different diseases, such as cystitis, digestive, colic, furuncles, and asthma and as an anthelmintic, emmenagogue and anticovulsion agent. In Iranian traditional medicine, *Dorema aucheri* Boiss. was used against asthma, bronchitis, parasites of digestive system, constipation and burns. The genus *Oliveria* is represented only by a single species, namely *Oliveria decumbens* Vent., in Iran. It was traditionally used for the treatment of different diseases such as indigestion, diarrhea, abdominal pain, feverish

conditions, stomach pain and cold and to relieve thirst in children.

Credibility of plant species used in ethnobotany

Due to the interdisciplinary nature of ethnobotany, few individuals can be expected to be experts in all components of the cross-disciplinary research that ethnobotany represents in botany, pharmacology, medicine, chemistry, anthropology and linguistics. Therefore, it needs a close collaboration of multidisciplinary teams of researchers who are experts in botany, pharmacology, medicine and anthropology (Alexiades and Sheldon, 1996). Unfortunately, in Iran, botanists are not really involved in this field of inquiry, even though botany is one of the basic fields involved in interdisciplinary field of ethnobotany. Most of the studies in Iran have been done by pharmacognosists and anthropologists. Improvement of ethnobotany and ethnopharmacology in Iran needs more involvement of botanist in these fields (Ghorbani et al., 2006). Sometimes, the studies of ethnobotany, can comprise a few incorrect identifications. Botanists attempt to record a much lower number of erroneous ethnobotanical taxa. Reports on plants which do not exist in Iran may be a result of plant misidentification. For example, in the literature review of this family in Iran, we found that *Eryngium campestre* L. has been recorded for ethnobotanical uses (Mirdeilami et al., 2011). However, according to Flora Iranica, this species does not exist in Iran (Mozaffarian, 2007). Therefore, we have removed this plant from the list (Table 1). In some cases, identical names are given to different species, or various names to the same species. This is particularly important for taxa that are marketed. Owing to some morphological similarities of the plant parts and their improper identification by the consumers and herbal plant sellers and lack of a standard identification system, the crude medicinal

plants and their parts are often adulterated or substituted in commerce which may result in the loss of their efficacy. For instance, *Zosima absinthifolia* Link adulterated or substituted instead of *Levisticum officinale* W.D.J.Koch in some commercial samples. Identification and recognition of medicinal plants are very important because the adulterants, although belonging to the same genus, do not possess the medicinal properties of the drug. For example, *Bunium cylindricum* is being mixed with real Zireh-e-siah (*Bunium persicum*) and is sold in the market but with less quality and efficacy. Correct identification of plant species is the foundation of safe use of herbal medicines and products. Therefore, in order to ensure safety, therapeutic potency and efficacy of lucrative and medicinal plants, correct identification, authentication, and elimination of adulteration are essential and the taxa should only be authenticated by a panel of experts including taxonomists (Joharchi and Amiri, 2012).

Comments on conservation status of some notable species

Some of species have a narrow distribution and collection from wild populations will threaten these taxa. Furthermore, various parts of plants should only be collected in such a manner that ensures their continued presence, both in specific collection locations and across the landscape (Meeker et al., 1993). Harvesting from wild populations and destructive collecting methods, such as removal of subterranean and aerial parts which are essential to the survival of the plants, could be serious threats and often lead to vanish this species. Various species of Apiaceae family are monocarpic, so that only once produce flowers during the life cycle and only reproduce through seeds such as *Ferula spp.* Excessive harvest of roots and flowers of these species are dangerous, and must be avoided, especially in the case of endemic and endangered species. Of the 70 plant

species included in this review, 17 taxa were listed as endemic. Some of these species such as *Dorema aucheri* Boiss., *Echinophora cinerea* (Boiss.) Hedge & Lamond, *Ferula hezarlalehzarica* Ajani and *Kelussia odoratissima* Mozaff. are narrow-range endemics and occur only in a few specialized niches. *Heracleum gorganicum* Rech.f. is an endemic species of Iran which is widely and heavily harvested from the wild and this could be a big threat for these species (Ghorbani, 2005). *Dorema aucheri* Boiss. is considered as an endemic species which is heavily collected. Excessive collection of these plants has caused a notable decrease in populations of the plant in the area. Many individuals of young plants are harvested to be sold (Mosaddegh et al., 2012). *Kelussia odoratissima* Mozaff. is another endemic species with a narrow distribution range in Iran which is subjected to heavy use by inhabitants of the region. The local people are using the whole plant for different purposes. Excessive collection of it has led to the decrease of the plant in the area. Some rare species such as *Levisticum officinale* and *Dorema ammoniacum* have been threatened as herbalists and traders hire the local people for collecting these species due to the economic purposes. In addition, local people sometimes sell these medicinal plants in the local market for making money (Rajaei et al., 2012). Many of these plants are potentially endangered and vulnerable taxa. Collecting of plants from the wild led to the impoverishment of various plant communities in many areas, especially for plants that their roots or flowers are used, and that harvesting should be controlled. So, sustainable harvesting and domestication of these plants is a need for conservation which would guarantee these renewable resources for the future. Special consideration should be given to promising plants in the area and protect them from extinction by excessive utilization.

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Table 1. Importance of ethnobotanical applications of Apiaceae family in Iran

NO	Scientific name	Vernacular name	Part used	Preparation	Medicinal uses (Human)	Medicinal uses (Livestock)	Non-medicinal uses	Reference cited
1	<i>Ammi majus</i> L.	Khelale-dandan	Fruit	-	Flatulency, Diuretic, Tonic, digestant, dyspepsia	-	-	Safa et al., 2013; Dolatkahi et al., 2012;
2	<i>Ammi visnaga</i> (L.) Lam.	Khelale-dandan	Aerial parts	-	Tonic, treatment of gingivitis, Digestive disorders, Carminative, appetizer	-	-	khodayari et al., 2015.
3	<i>Anethum graveolens</i> L.	Shevid, Toragh	Fruit-Shoot	Infusion	Abortion, Anti-Dysmenorrhea, Galactagogue, Antihyperlipidemia, Carminative, Treatment of Diabetes, Digestive disorders, Infertility treatmentmen	-	Culinary	Amiri and Joharchi, 2013; Ghorbani, 2005; Sharififar et al., 2010; Dolatkahi et al., 2012; Sadeghi and Mahmood, 2014; Azizi and Keshavarzi, 2015; Dolatkahi and Nabipour, 2014; khodayari et al., 2015.
4	<i>Anthriscus sylvestris</i> (L.) Hoffm	Jenjil	Leaf; root	-	Treatment stomachache, Antihyperlipidemia, Stomach tonic	-	-	
5	<i>Apium graveolens</i> L.	Karafs	Fruit, Leaf; Stem	Decoction	Carminative, Tonic, Emmenagogue, Diuretic, Liver disorders, asthma, Loss of appetite, Rheumatic, Lumbago	-	Culinary	Hopper and Field, 1937; Amin, 1992; Amiri and Joharchi, 2013; Ghorbani, 2005; Mardaninejad et al., 2013; Nazemiyeh et al., 2009.
6	<i>Astrodaucus orientalis</i> (L.) Drude	Havij-e-kohi	Whole plant	-	-	-	used as a salad, vegetable and a food additive	
7	<i>Bunium persicum</i> (Boiss.) B.Fedtsch.	Zireh-e-Siah	Fruit	Decoction, powder	Obesity, Galactagogue, Flavoring, Carminative, Calmative, Appetizer, Indigestion, decongestant, children earache, newly delivered ladies recovery, cold-natured treatment, strengthening weaknesses	-	Flavoring	Amiri and Joharchi, 2013; Safa et al., 2013; khodayari et al., 2015; Sharififar et al., 2010; Amiri et al., 2012.
8	<i>Bupleurum falcatum</i> L.	-	Leaf; seed	Decoction, poultice	Fever, dermal wound, Joint pain and inflammations	-	-	Rajaei et al., 2012.
9	<i>Carum carvi</i> L.	Zireh-e-Shami	Fruit	Infusion	Obesity, Facilitate digestion, Sour stomach, Blood pressure, Diarrhea	Ectoparasites, Digestive and Gastric troubles, Skin diseases, Fever, Dehydration, Mouth infection	Flavoring	Mardaninejad et al., 2013; Sadeghi and Mahmood, 2014; Ghorbani et al., 2014.
10	<i>Chaerophyllum macropodium</i> Boiss.	Garkava, Chelghaba	Young stem	-	-	-	Eaten with rice	Mosaddegh et al., 2012.

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11	<i>Coriandrum sativum</i> L.	Geshniz, Geshnij	Fruit	Decoction	Relieve headache, relieve toothache jaundice, Acne, Treat of Flatulence, Appetizer, Aphrodisiac, Antiseptic, Gasteralgia, sore throat, Aromatic, Painkiller, Diabetes control, Gout control	-	Flavoring, culinary	Hopper and Field, 1937; Amin, 1992; Amiri et al., 2014; Ghorbani, 2005; Tahvilian et al., 2014; Mardaninejad et al., 2013; Azizi and Keshavarzi, 2015.
12	<i>Conium maculatum</i> L.	Shokaran	Root	-	Cholagogue, Depilator, Treat of Dermal Allergies	-	-	Amiri and Joharchi, 2013.
13	<i>Cuminum cyminum</i> L.	Zireh-e-Sabz	Fruit	Infusion	Relieve pain after child-birth, Carminative, Treat of Colic, Galactagogue, Obesity, Digestive, Favoring, Antiasetic	Increase libido female camel, Anti-bloat in cattle and sheep	Flavoring, culinary	Hopper and Field, 1937; Amin, 1992; Amiri and Joharchi, 2013; Sharififar et al., 2010; Koohpayeh et al., 2011; Safarnejad et al., 2011.
14	<i>Cuminum setifolium</i> (Boiss.) Kos.-Pol.	Zireh-e-Sefid	Fruit	-	Carminative	-	Spice	Safarnejad et al., 2011.
15	<i>Daucus carota</i> L.	Havij	Fruit, root	-	Diuretic, Emmenagogue, Disposal of worms, constipation, appetizer and Diuretic	Endoparasites	Edible, culinary	Amiri and Joharchi, 2013; Sharififar et al., 2010; khodayari et al., 2015; Ghorbani et al., 2014.
16	* <i>Dorema ammoniacum</i> D. Don	Kandal, Vasha, Ushgeh	Gum, root	Infusion, poultice	Indolent tumors, cystitis, Digestive, treat of colic, Treat of Furuncles, laxative, Expectorant, Asthma, Anthelmintic, Emmenagogue, Anticovulsion	Infectious wound healing and infection, Abscess in the sheep and goat	-	Hopper and Field, 1937; Amin, 1992; Amiri and Joharchi, 2013; Rajaei et al., 2012; khodayari et al., 2015; Sadeghi and Mahmood, 2014; Koohpayeh et al., 2011.
17	* <i>Dorema aucheri</i> Boiss.	Kal, Bilhar	Gum, young aerial part, root	Fresh paste	Asthma, Expectorant, Bronchitis, Making Gum, Parasites of digestive system, constipation, Burn healing	Infectious wound healing and infection in sheep	Edible, use as vegetable, young stems are pickled	Rajaei et al., 2012; Mosaddegh et al., 2012; Tahvilian et al., 2014; Koohpayeh et al., 2011; Mozaffarian, 2013.
18	<i>Dorema aureum</i> Stocks	Oshtork	Gum	Decoction, cataplasm	Abortion, aphrodisiac, Scorch	-	-	Sadeghi and Mahmood, 2014; Sadeghi et al., 2014.
19	<i>Dorema glabrum</i> Fisch. & C.A.Mey.	-	Leaves, gum-resin	-	Diuretic, anti-diarrheal, treatment of bronchitis and catarrh	-	Used as a green vegetable	Delnavazi et al., 2015.
20	<i>Ducrosia anethifolia</i> (DC.) Boiss.	Gicho, Goatk, Mashgak, Baghiz	Aerial parts, leaf, seed	Decoction	Carminative, Irregularities of Menstruation, lactiferous	-	-	Rajaei et al., 2012; Sadeghi and Mahmood, 2014; Sharififar et al., 2014; Dolatkahiani and Nabipour, 2014.
21	* <i>Echinophora cinerea</i> (Boiss.) Hedge & Lamond	Phyaleh	Aerial parts	-	Stimulant and an invigorator of the stomach, diuretic, anti-cancer	-	Spice	Shafie-zadeh, 2002.
22	* <i>Echinophora platyloba</i> DC.	Khosharizeh	Aerial parts	Decoction	Dissolves renal calculi, Anti aphthous (Mouth wash), antifungal	-	Spice, flavoring with yogurt, culinary	Tahvilian et al., 2014; Pirbaloutiet al., 2010; Abbasi et al., 2012.

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23	<i>Eryngium billardieri</i> Delile	Zole,kharzul, Chichagh	Aerial parts, root	Decoction	Constipation, palliative, antifungal, arthritis pain reliever	-	-	Mosaddegh et al., 2012; Abbasi et al., 2012; Sharififar et al., 2014.
24	<i>Eryngium bungei</i> Boiss.	Zole-e-Khorasani	Aerial parts	-	Painkiller	-	-	Sharififar et al., 2014.
25	<i>Falcaria vulgaris</i> Bernh.	GhazYaghi,Paghaz e	Leaves,fruit	Decoction	Treat of Vitiligo, Cut, Wound,Carminative, Febrifuge, Hemostatic	-	-	Amiri and Joharchi, 2013; Tahvilian et al., 2014.
26	* <i>Ferula assa-foetida</i> L.	Anghuzeh, Heltit, Gane-bu	Gum	Decoction	Stomachache,Anthelmintic, Antihemorrhoid, Cough, Tremor,epilepsy, treatment of gastritis	-	Culinary	Emami et al., 2012; Safa et al., 2013; Mosaddegh et al., 2012; khodayari et al., 2015; Sharififar et al., 2010; Sadeghi and Mahmood, 2014; Sajjadi et al., 2011.
27	<i>Ferula badrakema</i> Koso-Pol.	-	Resin	-	Anticonvulsant, tonic, anti-hysterical, decongestant, treatment of neurological disorders, stomach ache	-	-	Zargari, 1996.
28	* <i>Ferula behboudiana</i> (Rech.f. & Esfand.) D.F.Chamb.	Kame,Anio	Stem, leaves, inflorescence	Smoking, Sodden	Anti-septic	Appetizer	-	Bahmani et al., 2012; Pirbalouti et al., 2013.
29	<i>Ferula diversivittata</i> Regel & Schmalh.	-	Root	-	Anticonvulsant, tonic, anti-hysterical, decongestant, treatment of neurological disorders, stomach ache	-	-	Zargari, 1996.
30	<i>Ferula foetida</i> (Bunge) Regel	Anghuzeh	Gum	-	Anthelmintic, Treat of Colic,Emmenagogue	-	-	Amiri and Joharchi, 2013.
31	<i>Ferula gummosa</i> Boiss.	Barijeh,Angiyun,G hasni	Fruit, gum, root	Decoction, poultice	Appetizer, treatment of wounds, cysts, Anthelmintic, Anticatarrrhal, Antiallergic, Dyspepsia, Emmenagogue	liver	Powdered fruits, stem as pickle	Hopper and Field, 1937; Amiri and Joharchi, 2013; Ghorbani, 2005; Mosaddegh et al., 2012; khodayari et al., 2015; Amiri et al., 2012.
32	<i>Ferula haussknechtii</i> H.Wolff ex Rech.f.	Komeh, Komieh	Stem, leaves, inflorescence	smoking	Anti-septic	-	-	Pirbalouti et al., 2013.
33	* <i>Ferula hezarlahzarica</i> Ajani	Kahoovahshi	Stem, rhizome	Hydrodistillation	Stomachache, Carminative	-	-	Rajaei et al., 2012.
34	* <i>Ferula latisecta</i> Rech.f. & Aellen	Sasekoma	Leaves	-	Indigestion and anthelmintic	-	-	Amiri et al., 2012.
35	* <i>Ferula macrocolea</i> Boiss.	Chevil	Leaves, stem	-	Anti-nausea, anti-stomach acid	-	-	Khodayari et al., 2015.
36	<i>Ferula oopoda</i> (Boiss. & Buhse) Boiss.	Ejek-ghamaghi, kal	Seed, gum	Demulcent, vapor, pill	Cough, asthma, respiratory disorders, migraine, expectorant	-	-	Ghorbani, 2005; Sharififar et al., 2014.
37	<i>Ferula ovina</i> (Boiss.) Boiss.	Kama	Shoot, fruit	Decoction	Anticonvulsants, Tonic, constipation,Back pain treatment	-	-	Abbasi et al., 2012; Ahmadi et al., 2009; Sajjadi et al., 2011.

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38	<i>*Ferula persica</i> Willd.	Sakbinaj, Jarand	Stems, roots, leaves, gum	Poultice, vapor	Lumbago, rheumatism, gout, sinusitis, pododynia, backache, Treat epilepsy, laxative, antitussive	-	Steam cooked, Spicy, cooking, edible	Hopper and Field, 1937; Ahvazi et al., 2012; Sahranavard et al., 2014; Sharififar et al., 2014.
39	<i>Ferula szowitziana</i> DC.	Ghamagh-mumi, Anghozeshirin	Gum	Demulcent, vapor, pill	Asthma, cough, dermal wounds, stomach pain	-	-	Ghorbani, 2005; Sharififar et al., 2010.
40	<i>Ferulago angulata</i> (Schltl.) Boiss.	Chavil, Chavir	Leaves	-	Anti-septic, renal pain	Relieve flatulence	As aromatic ingredient, as flavor in animal oil, spice and air fresher	Mosaddegh et al., 2012; Ahmadi et al., 2009; Pirbalouti et al., 2013;
41	<i>*Ferulago carduchorum</i> Boiss. & Hausskn. ex Boiss.	Garchik	Gum	Poultice	Dermal wounds	-	-	Rajaei et al., 2012.
42	<i>Foeniculum vulgare</i> Mill.	Raajuneh, Razianeh	Aerial parts, Fruit	Decoction	Relieve toothache, Dysentery, Cold, Diuretic, kidney infections, Galactagogue, Digestive, Bronchitis, Appetizer, Antiacid, Flatulence, hypnotic	-	Edible, flavoring	Hopper and Field, 1937; Amin, 1992; Amiri and Joharchi, 2013; Ghorbani, 2005; Mosaddegh et al., 2012; khodayari et al., 2015; Sharififar et al., 2010; Sadeghi and Mahmood, 2014; Mozaffarian, 2013.
43	<i>Froriepia subpinnata</i> (Ledeb.) Baill.	Zolang	Aerial parts	-	-	-	As a local vegetable, as a local spice, flavoring	
44	<i>Grammosciadium platycarpum</i> Boiss. & Hausskn.	Jafarikohi, Samoureh	Leaves	Infusion	Tonic, carminative and relief stomachache	-	Edible, cooking some foods, as a local vegetable and flavoring in soups and foods	Ahvazi et al., 2012; Yazdanshenas et al., 2015; Sonboli et al., 2005.
45	<i>*Haussknechtia elymaitica</i> Boiss.	Kelos-e kuhi	Aerial parts	-	Diabetes, hypertension	-	-	Mosaddegh et al., 2012.
46	<i>*Heracleum gorganicum</i> Rech.f.	Jengel-ghamaghi	Seed	-	Digestive disorders	-	Flavoring	Ghorbani, 2005.
47	<i>Heracleum persicum</i> Desf. ex Fisch., C.A. Mey. & Avé-Lall.	Golpar	Fruit, flowers	Infusion, decoction	Treat of Hiccup, Appetizer, Flavoring, Carminative, Anthelmintic, Stomach Tonic, Tremor, migraine, headache caused by sinusitis	-	Spice, flavoring	Amiri and Joharchi, 2013; Ahvazi et al., 2012; khodayari et al., 2015.
48	<i>Johrenia aromatic</i> Rech.f.	Baraza	Leaf, root	Decoction	Dissolves renal calculi, cornicide	-	-	Tahvilian et al., 2014.
49	<i>*Kelussia odoratissima</i> Mozaff.	Kelus, karafs-e-Bakhtyari	Whole plant	-	Indigestion, rheumatism, Gastric ulcer, anti-diabetes, pain, cough, Irritation, Sedative	-	Edible as vegetable, Flavoring with yogurt	Pirbalouti et al., 2010; khodayari et al., 2015.
50	<i>Lagoecia cuminoides</i> L.	Alaf-e kaaji, Zireh-e-vahshi	Aerial parts	Infusion	Bile stone repellent, Diarrhea	-	-	Safaet al., 2013; Mosaddegh et al., 2012; Dolatkahi and Nabipour, 2014.

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51	<i>Levisticum officinale</i> W.D.J.Koch	Angedane-roomi, Karafse-kuhi	Fruit, leaf, root	Infusion	Nerve Diseases, Heart Tonic, Indigestion, Blood sugar, Asthma, diuretic	-	Flavoring with yogurt, use as vegetable	Amiri and Joharchi, 2013; Rajaei et al., 2012.
52	* <i>Oliveria decumbens</i> Vent.	Moshkurak, Tighnak, Den	Aerial parts	Decoction	Relieve thirst in children, indigestion, diarrhea, abdominal pain and feverish conditions, Stomach pain, cold therapy	Diarrhea	Culinary, use as vegetable	Mosaddegh et al., 2012; khodayari et al., 2015; Dolatkhahi et al., 2012; Bahmani et al., 2012; Dolatkhahi and Nabipour, 2014. Pirbalouti et al., 2013.
53	<i>Opopanax hispidus</i> (Friv.) Griseb.	Alafshir	Stem, leaves, inflorescence	Smoking	Anti-septic	-	-	
54	<i>Petroselinum crispum</i> (Mill.) Fuss	Jafari	Fruit	Infusion	Emmenagogue, Diuretic, Carminative, Kidney Disorders, Bladder disease, Gout, Blood pressure, Blood sugar, Varicocele	-	Edible as vegetable, flavoring	Amiri and Joharchi, 2013; Mardaninejad et al., 2013
55	<i>Peucedanum officinale</i> L.	Bokhurol ekrad	Gum	-	Diuretic, Cough, Meningitis, Paralysis, Renal stone, Respiratory ulcers	-	-	Zarshenas et al., 2013.
56	<i>Peucedanum ruthenicum</i> M.Bieb.	Razianekoohi	Fruit	-	Treatment of cold	-	-	Alavi et al., 2005.
57	<i>Physospermum cornubiense</i> (L.) DC.	Ghaziaghi	Stem	-	-	-	Edible	Mirdeilami et al., 2011.
58	<i>Pimpinella anisum</i> L.	Vavehshing, Anison (Badianroomi)	Fruit	Infusion	Treat of Flatulence, Anthelmintic, Treat of Colic, Antacid, Stomachache, Antidiarrhea	-	Culinary use	Hopper and Field, 1937; Amin, 1992; Pirbalouti et al., 2013; Amiri and Joharchi, 2013; Sadeghi and Mahmood, 2014.
59	* <i>Prangos cheilanthifolia</i> Boiss.	Sakbinj	Aerial parts	-	Treatment of flatulency	-	-	Shariffar et al., 2014.
60	<i>Prangos ferulacea</i> (L.) Lindl.	Bale har, Ginoo, Marzah	Aerial parts	Decoction	Laxative, Anti-parasitic, Anti-cancer, Carminative	Treatment of thick and louse (Ruminants)	As a natural dye	Pirbalouti et al., 2013; khodayari et al., 2015; Azizi and Keshavarzi, 2015; Barani and Rahimpour, 2014; Ghorbani et al., 2014.
61	<i>Prangos uloptera</i> DC.	Jashir-e- sakhrehrooy	Fruit, flower	-	Tonic, Carminative	-	-	Sajjadi et al., 2011.
62	* <i>Psammogeton canescens</i> Vatke	Shen jar	Aerial parts	-	Disinfectants	-	Flavoring	Sajjadi et al., 2011.
63	<i>Pycnocycla aucherana</i> Decne. ex Boiss.	Sagdandan	Leaves, stem	-	Back, leg and other part muscles pain	-	-	Safa et al., 2013.
64	<i>Scandix pecten-veneris</i> L.	Suzanak	Aerial parts	Decoction	Palpitation, blood coagulation, pains	body	-	Mosaddegh et al., 2012.
65	<i>Scandix stellata</i> Banks & Sol.	Badian-e-koohi	Whole plant	-	Stomach tonic, Has a hot temper	-	-	Shariffar et al., 2014.

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66	<i>Seseli tortuosum</i> L.	Sisalius	Whole parts	-	Treat epilepsy	-	-	Sahranavard et al., 2014;
67	<i>Smyrniun cordifolium</i> Boiss.	Ovandol, Pinoume, Gonour	Aerial parts, seeds, root	Infusion, Sodden	Urinary ducts and prostate problems, gynaecological disease, Indigestion and stomachic, Bitter aromatic, hot effects, tonic, anti-helminthic, Antipyretic, anti-worm tooth	Urinary retention	Roots and stems as a food to be consumed raw or cooked	Mosaddegh et al., 2012; Ahvazi et al., 2012; Tahvilian et al., 2014; Pirbalouti et al., 2013; Bahmani et al., 2012; Ahmadi et al., 2009.
68	<i>Tetrataenium lasiopetalum</i> (Boiss.) Manden.	Goolpar, Kereson	Fruit	-	Anti-septic	-	Spice and condiment	Pirbalouti et al., 2010.
69	<i>Trachyspermum ammi</i> (L.) Sprague	Zenyan (Khordaneh), Kasrak	Fruit	Infusion	Carminative, Anthelmintic, Antidiarrhea, Treat of Colic, Antacid, Galactagogue	-	Flavoring	Amiri and Joharchi, 2013; Sharififar et al., 2010.
70	<i>Turgenia latifolia</i> (L.) Hoffm.	Darehjouyi	Aerial parts	Infusion	Urinary duct problems	-	-	Mosaddegh et al., 2012.

The species marked with an asterisk (*) are endemic species belonging to Apiaceae family in Iran

Conclusion

This paper clearly represents a deep-rooted ethnobotanical heritage of Apiaceae family in Iran. Traditional knowledge of Iranian peoples is based on oral tradition passed through several generations and most of this information survives only in the memory of the elderly people and is now in danger of vanishing. This review illustrates the necessity of ethnobotanical works in various regions of Iran to record all the folkloric knowledge practiced among indigenous people and attempts to compile these scattered data in order to help maintaining cultural traditions. The best and quickest way to species selection for pharmacological and phytochemical works is by reviewing the ethnobotanical literature. This highlights the significance of such investigations. Based on the data of this paper some taxa should be given priority for further phytochemical and pharmacological studies, including: *Dorema glabrum* Fisch. & C.A.Mey., *Echinophora cinerea* (Boiss.) Hedge & Lamond, *Johrenia aromatic* Rech.f., *Opopanax hispidus* (Friv.) Griseb. and *Pycnocycla aucherana* Decne. ex Boiss. Some species are good candidates for future research, specially in the case of endemic species. The flora of Iran is rich in endemic species of Apiaceae (122 taxa), many of which have been poorly investigated. These taxa are unique and potentially interesting as a basis for future research works. To our knowledge, there is no literature on some notable species that have been traditionally used in Iran such as *Azilia eryngioides* (Pau) Hedge & Lamond, *Ferula macrocolea* Boiss., *Hausknechtia elymaitica* Boiss., *Heracleum gorganicum* Rech.f., *Kalakia marginata* (Boiss.) Alava, etc. Identification of plants in each area provides a better understanding of restorable natural resources and their applications. Ethnobotanical efforts should continue, particularly in regions that have received less attention. It is strongly believed that detailed data as introduced in

this paper on the ethnobotany of Apiaceae, provides detailed evidence for the use of these plants for different purposes. Regarding the rich background of traditional knowledge of these species, it seems there are still a large number of unaccomplished researches, which provides baseline data for subsequent pharmacological and phytochemical investigations.

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Conflict of interest

There is no conflict of interest in this study.

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