

# Quantitative investigation on ethnobio-pharmacological parameters of indigenous medicinal

# plants of Darab region, Fars, Iran

Saeed Jafarirad<sup>1\*</sup>, Mohammad Javad damanafshan<sup>1</sup>

<sup>1</sup> Research Institute for Fundamental Sciences (RIFS), University of Tabriz, Tabriz, Iran

\*jafarirad@tabrizu.ac.ir

# Abstract

Up to now, there is one reported literature regarding plants used by Darab healers in Fars, Iran, for treating diseases. Current study reports, for the first time, major ethnobio-pharmacological parameters in respect of quantitative on remedies and herbs in Darab.

Forty applicants including traditional health practitioners (THPs) and indigenous people were interviewed about the plants they use against diseases in folk medicine via open-ended and semi-structured questionnaire.

A total of 52 species from 24 families were reported by the informants of this study; these uses originated from 126 plants and 47 families and were mainly represented by Asteraceae, Lamiaceae and Rosaceae.

Informant consensus factor (Fic) values of this research depicted the maximum agreement in the use of species in the treatment of venomous bites and gastro-intestinal problems among the indigenous people. In addition, 3 species of plants containing *Portulaca oleracea L*, *Peganum harmala L. and Anthemis altissima L.* had the highest fidelity level (FL) of 100%. Thymus daenensis Celak showed the highest relative importance (RI) value of 1.92.

The authors propose giving significance for more phytochemical investigation to plants that accrued maximum FL, Fic, RI values. It is due to the fact that such data could be reflected as suitable aspects of integrative medicine for discovering new drugs.

Keywords: Integrative medicine; Ethnobotonical survey; Indigenous people; Darab; Iran.

## Introduction

Plants have constituted remedies in traditional medical systems for centuries and are still being used as a source of bioactive compounds with pharmaceutical and agrochemical interest. According to the World Health Organization (WHO), about 4 billion people in developing countries not only trust in the therapeutic properties of medicinal plant but also use them consistently (1-7). The conference of safe guarding in tangible cultural heritage founded that the information and practices about nature are part of human kind cultural heritage (8). Moreover, ethnobotany, ethnoecology and traditional medicine between others, are known as important factors of culture and accordingly they should be preserved (9-12). Traditional medicine using herbal preparations in the Iranian culture is documented since 1900 B.C. "Iranian pharmacopoeia" included remedies from vegetal, mineral and animal origin, in order to relieve different diseases. The south of Zagros mountain chains, in central part of Iran, has a rich flora due to its variable climate and high number of ecological zones (Fig 1). Darab, Fars province, has a variety of vegetation zones due to climate and good rainfall years. This diversity inflora provides a rich source of medicinal plants, which has long been utilized by Iranian cultures, and consequently accounts for the development of outstanding traditional medicine in the region (3-15). In one hand, increasing attention to medicinal plants use in Iran could be attributed to the increasing price of remedy drugs (16-18). Therefore, people attend to "Hakim" or traditional health practitioners (THPs) in order to treat their illnesses. Because, Hakim culture is a traditionally knowledge about medicinal plants has been a matter of traditional healers men. On the other hand, the number of pharmacies is proportional to the number of inhabitants. Therefore, in these villages there are only a few pharmacies, or they are totally absent. For this reason, in every village there is a bazaar in which all traditional remedies, seeds, fruits, drugs and spices are sold. Unfortunately, in the recent years, medicinal plants and the related data are being extremely exhausted in Darab. It could be as a result of migrations of Hakims to other jobs. It could ultimately result in the quick loss of the traditional medicine.

In spite of the existence of a rich ethnic tradition in Darab, only one dedicated ethnobotanical review has been reported so far (5).

This study has been carried out among the local people and indigenous communities in Darab. However, this survey only has concentrated on qualitative analysis and did not include any qualitative investigation on ethnobiopharmacological parameters. Therefore, the present survey has been conducted in order to collect the information regarding traditional uses of medicinal plants utilized by the indigenous people in Darab. Finally, we have analyzed the data based on different qualitative and quantitative criterions to identify the most important species used in traditional medicine.

## **Materials and Methods**

## 3.1. Survey region

The surface area of the Darab is 7500 km<sup>2</sup>, and it is located in the south east of Fars Province of Iran at  $36^{\circ}46'N$ ,  $45^{\circ}43'E$ . The climate is mountainous which is 1180 meters above sea level with annual average temperature of 25 °C as well as annual rainfall is 350 mm. At the 2006 census, the county's population was 210,000. The main language of the indigenous population is Persian with Shirazi accent. The vegetation in natural area is lush but unfortunately in recent years due to both reduced rainfall and environmental degradation by people, the vegetation zone is reduced.

## 3.2. Interviewees Sampling

Interviewees were local traditional health practitioners (THPs) in addition to native people with practical or experiential information on medicinal plants. A total of 40 people were interviewed for this study. Through the selection of informants, gender, age, educational background and experience on use of traditional medicinal plants were taken into consideration (Table 1).

#### 3.3. Collection of ethnobio-pharmacological data

The questionnaire was completed through face-to-face interviews. During these interviews, only those persons who were familiar with medicinal plants were interviewed. The volunteers were selected from the citizens on the busy hours of the common areas such as bazaars, hospitals, gardens of Darab's city centers, towns, and villages. All informants were questioned by the second author alone in order to ensure confidentiality among them (19). Informants were asked to report the wild, cultivated or bought medicinal plants that had been traditionally used in the area, what ailments were treated with them, and whether they were still in use or abandoned (Table 2). The collected specimens were pressed, preserved and later identified by the Herbarium of Forests Range and Watershed Management Organization of Fars provenance, Shiraz. Research articles, books and relevant web pages were studied with the purpose to collect data of phytochemicals present in the plants. Then frequently found compounds in the reported plant species were listed. We, also, asked the local names of the plants, and how they were administered.

#### 3.4. Data evaluation

For data analysis, frequency of citation (FC) of the plants species being utilized was evaluated using eq. 1) (Table 3):

FC = (Number of times that a species was reported/ total number of times that all species were reported) ×100 (1)

The informant consensus factor (Fic) was considered with the following formula used by Heinrich et al (eq. 2) (4).

Fic = (Nur-Nt)/(Nur-1) (2)

Where 'Nur' and 'Nt' stands for the number of reports for a specific ailment and the number of taxa used for a specific ailment by all informants, respectively. Fic was applied to focus the sameness of the information about a specific plant use to treat a specific kind of illnesses (Table 4). In other words the Fic is a symbolic value of stability of the informants that how regularly they agree about the use of certain plant species for the dealing of a particular ailments category. The product of this factor ranges from 0 to 1. An illness having a high Fic value (close to 1) shows that relatively few taxa are used by a large proportion of the informants. A low value indicates that informants disagree on the taxa to be used in dealing within a category of illness.

Relative Importance Value (RI) was evaluated as eq. 3 (20):

RI=PP+AC (3)

PP = (the number of medical properties assigned to a species / the maximum number of medical properties assigned to the most resourceful species)

AC = (the number of ailment categories treated by a given species / the maximum number of ailment categories treated by the most resourceful species)

2.0 is the maximum value of RI, which shows the uppermost variety of medical applications of a species (Table 5).

Fidelity Level (FL) was evaluated via the formula as eq. 4(21):

FL=Ip/Iu×100 (4)

Where Ip and Iu refer to the number of informants who independently mentioned the application of a species for the same major ailment and the total number of informants who mentioned the plant for any major ailment, respectively. FL implies the frequency of use of the plant species for dealing a specific ailment category by the informants (Table 6).

Results

4.1. Interviewees

Among the 40 interviewees, 4 people are THPs and the others are local applicants. 28% and 72% of interviewees were men and women, respectively. There was a high percentage, nearly 50%, of interviewees who were more than 60 years (52.50%). In addition, the majority of interviewees were illiterate (Table 1).

#### 4.2. Medicinal herbs recorded

In the present study a total of 52 plant species belonging to 27 plant families are collected due to their medical importance utilized by THPs in Darab. Lamiaceae (10 species) shows the highest number of species, followed by Apiaceae (7species), Papilionaceae (6 species) and Asteraceae (4 species) (Fig 2).

#### 4.3. Evidences of the preparation

Depending on plant and disease different parts of the same plant such as leaf, root, bark, fruit and so on, are exploited for the treatment of different disorders. However, approximately for all plants, the leaves were used as main part of species. It is interesting that the old THPs have more restrictive instructions such as the time of the day to collect the plant. Different preparation methods are used for ordering herbal medicinal plants including decoction, distillate, burned, infusion, juice, powder, maceration and raw. The main mode of preparation is infusion followed by distillate. In many occasions, vegetal material is mixed with other ingredients such as sugar, honey or milks to easy its consumption or application, water being the most used solvent.

Gastro-intestinal complaints, Inflammation and pain and dermatology problems were the most common uses of plants. In the present study all kinds of plants (annuals, perennials, trees and shrubs) were studied. All studied species had a good abundance in terms of abundance except Arctium Lappa and Fraxinus excelsior L. The most cited plants are Thymus daenensis Celak, Anchusa italica Retz, Anthemis altissima L., Malva neglecta Wallr, Trachyspermum ammi Sprague, Glycyrrhiza glabra Land Portulaca oleracea L.

#### 4.4. Other evidences of the recorded medicinal herbs

As shown in Table 3 the most of the reported plants have been administered for more than one type of disorder/problem. The maximum deals of species have been used to treat gastro-intestinal ailments (39 species), inflammation and pain (26 species) and dermatology disorders (24 species).

Table 4 summarizes the Fic values obtained for the categorized ailment. The Fic values in our investigation were ranged from 0 to 1. The ailments categories with more than 39 use-reports are gastro-intestinal complaints (85 use-reports, 39 species), inflammation and pain (31

use-reports, 26 species) and dermatology problems (32 use-reports, 24 species). In our study the highest Fic value (1.00) was mentioned for venomous bites, followed by cancerous diseases (0.666) and gastro-intestinal complaints (0.547) and eye diseases (0.500).

Thymus daenensis Celak possessed the maximum number of pharmacological properties (23 properties) so it had a regularized PP value of 1.00 (5/5). Fumaria parviflora Lam has employed to treat 13 ailments categories. Its regularized AC value is 1.00 (13/13) and has the second highest RI value of 1.78 which followed by RI 1.92 assigned to Thymus daenensis Celak (Table 5).

Moreover, 77 plants mentioned by 5 informants for being used against a given ailment category. Among these plants, 20 species were from gastro-intestinal complaints and 6 species from nervous system and cold separately. Furthermore, 3 plants show the maximum amount of FL including Portulaca oleracea L., Peganum harmala L., Anthemis altissima L.

# Discussion

In the present investigation, about 65% of THPs were illiterate; however they had rather good knowledge on traditional remedies (Table 1). Literate people in the study area were found to be less knowledgeable on the use of medicinal plants as compared to illiterate ones due to the higher level exposure of the former to modernization. Similar results were reported in the studies conducted in Ethiopia, Thailand, and Turkey (22-24). In addition, during the interviews, it was determined that 80% of the people older than 50 have more knowledge than those under the age of 50. Most plants used in this study were as annuals and perennial plants. As a result of our analysis, the plant names used in Darab were found to be Persian language. It was seen that some plant names were adopted from Turkish language such as Goli ghamish and Yonje as a result of presence some Turkish tribes, Ghashghaei, in the region (Table 2). Most plants reported in this study were related to the family Asteraceae as an extended family, with 7534 specie (Fig 2). Most parts of the plants used by the indigenous people, were the plant's leaves which followed by flowers and stems (Table 2). It may be as a result of the fact that the leaves are leading organs of photosynthesis and accordingly have photosynthetic chemicals which might be responsible for medicinal values (25,17). In addition, there are much more methods for preparing them as herbal remedies (26-29). Based on our results, the frequently used remedies are decoction, distillate, burned, infusion, juice, powder, maceration and raw, which are practiced by the patients themselves. The main mode of preparation is infusion followed by Distillate. It was found that local people living in Darab and in its villages used 70% of these wild plants after drying. Drying enabled local people to use medicinal plants during all seasons of the year. Besides, they reported that they bought the plants from herbal shops when the plants were not seasonally available.

Based on the obtained information, a great number of indigenous plants are used to treat gastrointestinal diseases, inflammation and pain; dermatology and skin problems including burns, sores, and purulent rash; and respiratory problems (Table 3). This was mainly because there are no proper medical facilities especially in rural areas where indigenous people are physically involved with various kinds of health problems.

According to our calculation (Table 4) Venomous bites with maximum Fic show the most consent of the indigenous people in using the species of Achillea wilhelmsii C. Koch to treat these problems (30). A high Fic also depicts the possibility of containing key phytochemical ingredients in these plants (31). The reasons for the low value of the Fic can be due to (i) progress of human civilization which followed by rural people (32); (ii) lack of complete sorting of these illnesses in the rural areas (33); (iii) lack of appropriate links between native people (34); (iv) huge number of folk medicinal plants in Darab to treat a specific kind of illness that leading to decrease of inconsistency (32-34).

In the present study, RI values range between 0.11 (*Peganum harmala L.*) and 1.53 (*Thymus daenensis Celak*) (Table5). These values can be considered as minimummaximum when compared with those obtained for similar studies; in one of the recent studies the RI values were 1.46-1.86 (30). As RI values indicate the degree of knowledge shared on the use of medicinal plants in the treatment of diversity of diseases. It could be deducted from the obtained values that this degree of knowledge between indigenous people is low. *Peganum harmala L.*, for example, has the minimum amount of RI (Table 5). It may be attributed to two parameters as (i) less versatility against disorders (35) (ii) less abundance in the area (26).

Table 6 shows the maximum value of the FL for the species. The FL values of medicinal species are cited by THPs for being used against a given ailment category. It means that the highest FL values are more likely to be bio-active. In other words, it implies the prevalence of particular ailments, in Darab, that are treated with the medicinal plants with high FL values. Among the species with the highest FL, there are species with a very high FL such as Portulaca oleracea L. (100%), Anthemis altissima L. (100%), and Vicia sativa L. (97.14%). There are also taxa with medium FL such Rosa damascena Mill. (50.00%), Astragalus campylanthus Boiss. (52.94%)and Acanthophyllum C. A. Mey. (52.94%) (Table 6). The getting of the highest core of Portulaca oleracea L. (100%) and Anthemis altissima L. in the results of our survey could be

assigned to three reasons; (i) their ease of preparation as medicine (ii) their high abundance around the area and finally (iii) their excellent, rapid and versatile healing properties.

In addition, more experiences of rural people have not been assessed scientifically. In an ethnobotanic survey conducted in Iran, it is reported that *Mentha L*. had toxic effects (14,15). However, in Darab region, *Mentha L*. is being traditionally used for gastro-intestinal complaints. It, also, used for cold as well as bronchit symptoms (36). Therefore, it shows that THPs never know the toxicity of the medical plants in the area.

One the other hand, *Rosa damascena Mill.* is used in the region in the cases of oral, dental disorder and cardiovascular diseases. Interestingly, the other species of *Rosa* like *Rosa canina L.* (rosehip), is not used in the region despite of other parts of the world (37,38). It could be as a result of the fact that the plants grown in different climatic conditions may comprise dissimilar phytochemicals; consequently, it is not surprising that the traditional uses of different species could change in different origins. For instance, *Caesalpinia bonducella* has been exploited in Africa as a uterine stimulant, and this effect was depicted to be mediated through cholinergic effect (39), whereas has been used as an antispasmodic in south Asia (40).

In this study, we have shown that herbal treatment has become a tradition and plants can be a good resource for the residents of the study region. People living in Darab generally gather these plants in spring and first month of summer. The use of plants is due to lack of proper medical treatment as well as being far away from urban areas to rural areas. However, an experimental knowledge is necessary to identify constituent phytochemicals of local species in some cases. There was relatively high consistency in the use of local names between Darab and other parts of Iran. Relative importance values of plant species such as Fic, RI and FL were calculated. Our results show that THPs never know the toxicity of the medical plants of the study region. Furthermore, it appears that if ethnopharmacological survey is supported by phytochemical investigation could open the way to introduce new molecular approaches in pharmacology.

#### Acknowledgments

The authors express a lot of thanks to all the Traditional Health Practitioners and people involved in the interviews for providing information about the medicinal applications of the plants. And a special thanks to Mr. Kamran Holakoyi for assistance of this study.

Footnote

**Authors' Contribution:** Study idea, design, and protocol: Saeed Jafarird; writing of the manuscript: Saeed Jafarird; mohammad Javad Damanafshan critically reviewed the manuscript. All of the authors read and approved the final manuscript.

## References

Jamous RM, Ali-Shtayeh MS. The state of traditional Arabic Palestinian herbal medicine (TAPHM) in the Palestinian authority (West Bank and Gaza Strip). European Journal of Integrative Medicine. 2011;**30**:e130-1. doi: 10.1016/j.eujim.2011.05.050.

2. Baydoun S, Chalak L, Dalleh H, Arnold N. Ethnopharmacological survey of medicinal plants used in traditional medicine by the communities of Mount Hermon, Lebanon. Journal of ethnopharmacology. 2015;**15**:139-56. doi: 10.1016/j.jep.2015.06.052 [PubMed: 26165826].

3. Iwu MM. Ethnobotanical approach to pharmaceutical drug discovery: Strengths and limitations. Advances in Phytomedicine. 2002;**31**:309-20. doi:10.1016/S1572-557X(02)80034-4.

4. Heinrich M, Gibbons S. Ethnopharmacology in drug discovery: an analysis of its role and potential contribution. Journal of Pharmacy and Pharmacology. 2001;**53**:425-32. doi: 10.1211/0022357011775712. [PubMed: 11341358].

5. Moein M, Zarshenas M, Khademian S, Razavi AD. Ethnopharmacological review of plants traditionally used in Darab (south of Iran). Trends in Pharmaceutical Sciences. 2015;1:39-43. doi: 10.1016/j.eujim.2015.09.006

6. Hitziger MO, Berger-Gonzalez M, Gharzouzi E, Vides A, Ochaita D, Krütli P, Heinrich M. Patient-centred intercultural collaboration: An avenue towards integrative medicine in developing countries with socioculturally stratified societies? European Journal of Integrative Medicine. 2015;**25**:7-8. doi: 10.1016/j.eujim.2015.09.025.

7. Calvo MI, Akerreta S, Cavero RY. The pharmacological validation of medicinal plants used for digestive problems in Navarra, Spain. European Journal of Integrative Medicine. 2013;**31**(5):537-46. doi: 10.1016/j.eujim.2013.07.002.

8. UNESCOPRESS, Press Release No 2006-05, 2006, UNESCO1995-2007-ID: 31424.

9. Guarrera PM. Traditional phytotherapy in central italy (Marche, Abruzzo, and Latium). Fitoterapia. 2005;**31**(76):1-25. doi: 10.1016/j.fitote.2004.09.006. [PubMed: 15664457].

10.Guarrera, P.M., House hold dyeing plants and<br/>traditional uses in some areas of Italy. J. Ethnobiol.Ethnomed.2006;2(9)9-15.doi: 10.1186/1746-4269-2-9.[PubMed:16457717].

11. Bitu VD, Bitu VD, Matias EF, de Lima WP, da Costa Portelo A, Coutinho HD, de Menezes IR. Ethnopharmacological study of plants sold for therapeutic purposes in public markets in Northeast Brazil. Journal of ethnopharmacology. 2015;**22**:265-72. doi:10.1016/j.jep.2015.06.022. [PubMed: 26099635].

12. Reyes-García V, Huanca T, Vadez V, Leonard W, Wilkie D. Cultural, practical, and economic value of wild plants: a quantitative study in the Bolivian Amazon. Economic Botany. 2006;**60**(1):62-74. doi: 10.1663/0013-0001(2006)60.

13. Afshar, I., The Iranian's Traditional Medicine. Homa Press, Tehran, 1992.

14. Mir Heidar H. 1993. Encyclopedia of Medicinal Plants of Iran. Islamic Culture Press, Tehran.

15. Zargari, A., Medicinal Plants. University Publication, Tehran, 1992.

16. Mosaddegh M, Naghibi F, Moazzeni H, Pirani A, Esmaeili S. Ethnobotanical survey of herbal remedies traditionally used in Kohghiluyeh va Boyer Ahmad province of Iran. Journal of ethnopharmacology. 2012;**141**(1):80-95. doi: 10.1016/j.jep.2012.02.004. [PubMed: 22366675].

Studies on 17. Ghorbani Α. pharmaceutical ethnobotany in the region of Turkmen Sahra, north of Iran:(Part 1): General results. Journal of Ethnopharmacology. 2005;102(1):58-68. doi: 10.1016/j.jep.2005.05.035. [PubMed: 16024194].

18. Miraldi E, Ferri S, Mostaghimi V. Botanical drugs and preparations in the traditional medicine of West Azerbaijan (Iran). Journal of Ethnopharmacology. 2001;**75**(2):77-87. doi: 10.1016/S0378-8741(00)00381-0. [PubMed: 11297838].

19. Cotton, C.M., Ethnobotany: Principle and Application. John Wiley and Sons, New York, 1996.

20. Bennett BC, Prance GT. Introduced plants in the indigenous pharmacopoeia of Northern South America. Economic Botany. 2000;**54**(1):90-102. doi:10.1007/BF02866603.

21. Friedman J, Yaniv Z, Dafni A, Palewitch D. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. Journal of Ethnopharmacology. 1986;16(2):275-87. [PubMed: 3747566].

22. Giday M, Asfaw Z, Woldu Z. Medicinal plants of the Meinit ethnic group of Ethiopia: An ethnobotanical study. Journal of Ethnopharmacology. 2009;**124**(3):513-21. doi: 10.1016/j.jep.2009.05.009. [PubMed: 19454310].

23. Wester L, Yongvanit S. Biological diversity and community lore in northeastern Thailand. Journal of Ethnobiology. 1995;15:71-88.

24. Cakilcioglu U, Turkoglu I. An ethnobotanical survey of medicinal plants in Sivrice (Elazığ-Turkey).

Journal of Ethnopharmacology. 2010;**132**(1):165-75. doi: 10.1016/j.jep.2010.08.017. [PubMed: 20713142].

25. Balick, M. J., Cox, P.A., Plants, people, and culture: the science of ethnobotany. Scientific American Library, 1996.

26. Giday M, Asfaw Z, Woldu Z. Ethnomedicinal study of plants used by Sheko ethnic group of Ethiopia. Journal of Ethnopharmacology. 2010;**132**(1):75-85. doi: 10.1016/j.jep.2010.07.046. [PubMed: 20674734].

27. Poffenberger, M., McGean, B., Khare, S., Campbell, J., Field Method Manual, vol II. Community Forest Economy abd Use Pattern: Participatoey and Rural Appraisal (PRA) Methods in South Gujarat India. Society for Promotion of Wastelands Development, New Delhi, 1992.

28. Rehecho S, Uriarte-Pueyo I, Calvo J, Vivas LA, Calvo MI. Ethnopharmacological survey of medicinal plants in Nor-Yauyos, a part of the Landscape Reserve Nor-Yauyos-Cochas, Peru. Journal of ethnopharmacology. 2011;**133**(1):75-85. doi: 10.1016/j.jep.2010.09.006. [PubMed: 20837126].

29. Telefo PB, Lienou LL, Yemele MD, Lemfack MC, Mouokeu C, Goka CS, Tagne SR, Moundipa FP. Ethnopharmacological survey of plants used for the treatment of female infertility in Baham, Cameroon. Journal of ethnopharmacology. 2011;**136**(1):178-87. doi: 10.1016/j.jep.2011.04.036. [PubMed: 21540100].

30. Kadir MF, Sayeed MS, Mia MM. Ethnopharmacological survey of medicinal plants used by indigenous and tribal people in Rangamati, Bangladesh. Journal of ethnopharmacology. 2012;**144**(3):627-37. doi: 10.1016/j.jep.2012.10.003. [PubMed: 23064284].

31. Neves JM, Matos C, Moutinho C, Queiroz G, Gomes LR. Ethnopharmacological notes about ancient uses of medicinal plants in Trás-os-Montes (northern of Portugal). Journal of Ethnopharmacology. 2009;**124**(2):270-83. doi: 10.1016/j.jep.2009.04.041. [PubMed: 19409473].

32. Al-Qura'n S. Ethnopharmacological survey of wild medicinal plants in Showbak, Jordan. Journal of Ethnopharmacology. 2009;**123**(1):45-50. doi: 10.1016/j.jep.2009.02.031. [PubMed: 19429338].

33. Ragupathy S, Steven NG, Maruthakkutti M, Velusamy B, Ul-Huda MM. Consensus of the'Malasars' traditional aboriginal knowledge of medicinal plants in the Velliangiri holy hills, India. Journal of Ethnobiology and Ethnomedicine. 2008;4(1):8-17. doi: 10.1186/1746-4269-4-8. [PubMed: 18371206].

34. Rokaya MB, Münzbergová Z, Timsina B. Ethnobotanical study of medicinal plants from the Humla district of western Nepal. Journal of Ethnopharmacology. 2010;**130**(3):485-504. doi: 10.1016/j.jep.2010.05.036. [PubMed: 20553834]. 35. Ayyanar M, Ignacimuthu S. Ethnobotanical survey of medicinal plants commonly used by Kani tribals in Tirunelveli hills of Western Ghats, India. Journal of Ethnopharmacology. 2011;**134**(3):851-64. doi: 10.1016/j.jep.2011.01.029. [PubMed: 21291981].

36. Gruenwald J, Graubaum HJ, Busch R. Efficacy and tolerability of a fixed combination of thyme and primrose root in patients with acute bronchitis. A double-blind, randomized, placebo-controlled clinical trial. Arzneimittel-Forschung. 2004;**55**(11):669-76. doi: 10.1055/s-0031-1296916. [PubMed: 16366041].

37. Yeşilada E, Gürbüz I, Shibata H. Screening of Turkish anti-ulcerogenic folk remedies for anti-Helicobacter pylori activity. Journal of Ethnopharmacology. 1999;**66**(3):289-93. [PubMed: 10473175].

38. Savo V, Giulia C, Maria GP, David R. Folk phytotherapy of the amalfi coast (Campania, Southern Italy). Journal of ethnopharmacology. 2011;**135**(2):376-92. doi: 10.1016/j.jep.2011.03.027. [PubMed: 21419835].

39. Pakia M, Cooke JA, van Staden J. The ethnobotany of the Midzichenda tribes of the coastal forest areas in Kenya: 2. Medicinal plant uses. South African Journal of Botany. 2003;**69**(3):382-95. doi: 10.1016/S0254-6299(15)30321-5.

40. Billah MM, Islam R, Khatun H, Parvin S, Islam E, Islam SA, Mia AA. Antibacterial, antidiarrhoeal, and cytotoxic activities of methanol extract and its fractions of Caesalpinia bonducella (L.) Roxb leaves. BMC complementary and alternative medicine. 2013;13(1):101-11. doi: 10.1186/1472-6882-13-101. [PubMed: 23663985].

Variable	Categories	No. of	Percent
	-	person	
Informants	Traditional health practitioners	4	10
category	Indigenous people		
		36	90
Gender	Male	12	30
	Female	28	70
Age	Less than 20 years	-	-
	20–30 years	1	2.5
	30-40 years	2	5
	40–50 years	5	12.5
	50–60 years	11	27.5
	More than 60 years	21	52.5
Educational	Illiterate	26	65
background	Completed five years	6	15
	education	4	10
	Completed eight years	3	7.5
	education	-	-
	Completed 12 years education		
	Some under grade degree (16	1	2.5
	years education)		
	Graduate (higher education)		
Experience of the	10–20 years	5	12.5
traditional health practitioners	More than 20 years	35	87.5

PhOL

	Table 2.         Ethnomedicinal data collection							
Local name	Persian name	Scientific Name	Used part	How to use	Usage	Harvest time	Abundance	No. of person
Gala rakesha	Barhang	Plantago major L.	Leaf	unprepared	Analgesic for toothache, extirpation of body acne and suppurative	Spring	Abundant	9
Talkhe talkhe	Talkhe Talkhe	Acropilon repens	Stem	unprepared	Diabetes	Spring	Abundant	4
Gharbang	Panj Angosht	, Vitex agnus castus	Seed	Burning	Elimination of Dental larva	Spring	Abundant	12
Bezhan	Boomadaran	Achillea millefolium	Leaf	Decoction	Kidney Stones , Hematological diseases, Fungal disease, haematuria and scabies	Spring	Abundant	4
Bezhan	Boomadaran	Achillea millefolium	Leaf	Decoction	Washing	Spring	Abundant	1
Gogam	Gole mahoor	Verbascum thapsus	Leaf	unprepared	Skin burning	Spring	Abundant	1
Jatra	A'avishan	Thymus kotschyanus	Leaf, Stem	Infusion	Laxative, stomach ache	Spring	Abundant	25
Shilan	Nastaran	Rosa Canina	Fruit Leaf	Infusion	Elimination of Diabetes	Autumn	Abundant	3
Revas	Rivas	Rheum ribes	Root	Infusion	Elimination of Diabetes	Spring	Abundant	6
Memook	Shirin bayan	Glycyrrhiza echinata	Bulb	Infusion	stomach ache	Spring	Abundant	30
Hero	Khatmi	Althaea officinalis	Flower	Decoction	Strong laxative, Extirpation of body acne, Expectorant	Spring	Abundant	3
Hamisha bahar	Hamishe bahar	Calendula Officinalis	Sap	unprepared	Laxative	Spring	Abundant	15
Gog nasa	Piaz e Anasal	Drimia maritima	Bulb	Powder	Extirpation of body acne, softener	Spring	Abundant	5
Pr Pra	Kharfe	Portulaca oleraceae L.	Leaf	Infusion	Elimination of Diabetes	Spring	Abundant	5
Trsha ga	Torshak	Rumex acetosella	Bulb	Infusion	Extirpation of body acne	Spring	Abundant	6
Goli ghamish	Gol- e-ney	Phragmites australis	Bulb	Deccotion	Skin burning	Spring	Abundant	8
Gaz gask	Gazeneh	Urtica dioica	Leaf Bark, Stem	infusion	Respiratory problem	Spring	Abundant	6
Kartashi	Shekar tighali	Echinops ritrodes Bunge	Flower	infusion	Keep Solid Oil	Spring	Abundant	15
Kartashi	Shekar tighali	Echinops ritrodes Bunge	Sap	Infusion	Laxative	Spring	Abundant	13

PhOL

# Jafaridad, et al.

110 (pag 101-119)

Pnga	Pooneh	Mentha Iongiflorum	Leaf ,Stem	Infusion	Laxative, Carminative	Spring	Abundant	15
Yonje	Yonje	Medicago Sativa	Leaf	Infusion	Hematological diseases,	Spring, summer	Abundant	7
Haji laklak	Panirak	Malvasyl vestris	Leaf	Decoction	Laxative, cough	Spring	Abundant	1
Galay havidar	Baba Adam	Artium lappa	Leaf, Root	Infusion , Decoction	Cardiovascular diseases, Dermatology problem, Stomach worms, Sore throat,	Summer, Autumn	Rare	1
Chagh chagha	Ka'asnii	Chicoriom Intybus	Leaf	Decoction	Cardiovascular diseases	Spring	Abundant	1
Dara bii	Biid	Salix alba	Leaf, Fruit	Infusion	Sedative an Sleeping	Spring	Abundant	3
Bayboon	Babooneh	Anthemis tinctoria	Leaf , Fruit	Infusion	stomach ache, vomiting	Spring	Abundant	4
Voshtr khorka	Khar shotor	Alhagi camelorum	Bark, Stem Fruit	Infusion	Kidney Stones	Spring	Abundant	3
Pakoola	Khar khasak	Tribulus terrestris	Leaf , Fruit	Infusion	Kidney Stones	Spring	Medium	2
Friizoo	Biid giyah	Cyndon dactylon	Leaf , Fruit	Infusion	Kidney Stones, epilepsy and antidepressive	Spring	Medium	2
Gppzrovan	Gav zaban	Borago officinalis	Leaf , Fruit	Infusion	Kidney Stones	Spring	Medium	2
Baroo	Shah baloot	Castanea sativa	Fruit	Infusion	Ulcerative colitis	Autumn	Medium	4
Mazoo	Mazoo	Quercus infectoria	Fruit	Infusion	eyesight	Autumn	Abundant	3
Darbnav	Zaban gonjeshk	Fraxinus excelsior L.	Bark	unprepared	Cyst weakness, vermifuge and sterility	Summer, Autumn	Rare	3
Giasalma	Sa'alab	Orchis palustris	Bulb	Infusion	Ice cream , Weak laxative	Spring	Rare	
Gevizh	Zalzalak	Crataegus aronia	Fruit	Unprepared , infusion	Cardiovascular diseases	Autumn	Abundant	4
Drdook	Temeshk	Rubus fruticosus	Fruit	unprepared	Cardiovascular diseases	Summer	Abundant	4
Chnar	Chenar	Platanus orientalis	Stem	infusion	Tonic	-	Abundant	1

**Table 3.** Ailments grouped by different ailment categories (several diseases based onthe similarity in one category).

	, , , , , , , , , , , , , , , , , , , ,	
Illness categories	Medical terms	No of species used
Gastro-intestinal complaints	Stomachic, Stomach Pain, bellyache, Eupeptic, carminative, diarrhea,Flatulence, Anti-nausea, intestinal infection, Hiccup, Indigestion	39
Respiratory problems	Cough, bronchitis, asthma, expectorant, Lunginfection	23
Diabetes	Diuretic, anti-hyperglycemic	11
Inflammation and pain	pectoral pain, Migraine, Rheumatism, abdominal pain, Narcotic, Arthritis, Sedative, Anti-inflammatory	26
Urinary and rectal disorders	Frequent urination, Bladder calculi, Bladder Infection, Bladder pain, Hemorrhoids	7
Dermatology problems	Eczema, Diaphoretic, skin itching, Sores, skin tonic, Blue spots, Measles, Seeds festering bodies, Acne, skin Transparency, skin burns	24
Oral and dental disorder	Gums tonic, Oral thrush, Toothache	4
Infectious and parasitic diseases	Anti-parasitic, Antiseptic, Body Infection, Cyst	11
Cardiovascular diseases	Hypertension, Hyperlipidemia, Varicose, Heart disease, Vasodilators, Regulation of heartbeat, Heart tonic	19
Tumorous diseases	Body Inflation	8
Hematological diseases	Blood purifier, Anemia, Hemorrhage	13
Tonics	Anti-obesity, Vitamins, Body tonic, Stimulant	4
Fever	Febrifuge	8
Venomous bites	Scorpion sting, Snakebite	1
Hair growth stimulant/ antidandru	Alopecia, Hair Softener	3
Musculoskeletal disorders	Foot Pain, Muscle pain, Skeletal pain, Lumbago, Fracture	13
Female problems	Emmenagogue, Galactagogue, Uterine hemorrhage, Menorrhagia, Infertile female, Rancid milk female	9
Constipation	Laxative, Hydragogue, Chronic Constipation	14
Sexual stimulant	Aphrodisiac	2
Ear, nose and	Low Hearing, Catarrhal, Rhinorrhea, Sore throat, Epistaxis, Ear	11
throat disorder (ENT)	Infection, Otalgia	
Liver diseases	Gallbladder pain, Swollen spleen, Liver disease,	15
	Cholecystagogue,Liver Purifier, Jaundice, The gall bladder	-
Nervous system	Calm nerves, Vertigo, Nerves tonic, Convulsions, Depression, Nervous Diseases, Sciatica, Hypnotic	17

Ailment category	Number of	Number of	Informant
	use reports	taxa (Nt)	consensus factor
	(Nur)		(Fic)
Gastro-intestinal Complaints	85	39	0.547
Respiratory problems	31	23	0.226
Diabetes	11	11	0.000
Inflammation and pain	31	26	0.166
Urinary and rectal disorders	8	7	0.142
Dermatology problems	32	24	0.258
Oral and dental disorder	4	4	0.000
Infectious and parasitic	13	11	0.166
diseases			
Cardiovascular diseases	33	19	0.437
Tumorous diseases	8	8	0.000
Hematological diseases	15	13	0.142
Tonics	6	4	0.400
Fever	8	8	0.000
Venomous bites	2	1	1.000
Hair growth stimulant/	4	3	0.333
antidandruff			
Musculoskeletal disorders	23	13	0.454
Female problems	13	9	0.333
Constipation	18	14	0.235
Sexual stimulant	2	2	0.000
Ear, nose, throat disorder	12	11	0.090
Liver diseases	22	15	0.333
Nervous system	26	17	0.360
Renal diseases	13	10	0.250
Cold	13	12	0.083
Eye diseases	3	2	0.500
Cancerous diseases	4	2	0.666
Allergies	4	4	0.000

 Table 4. Informant consensus factor (Fic) for categorized ailments.

**Table 5.** Relative Importance (RI) values for Darab medicinal plants used against ormore specific use categories and three or more ailments categories treated.

Species	PP	AC	RI
Anchusa italica Retz.	0.56	0.84	1.40
Alhagi pseudalhagi (M. B.)	0.43	0.61	1.04
Desf.			
Foeniculum vulgare Miller	0.47	0.53	1.00
Thymus daenensis Celak	1.00	0.92	1.92
Achillea wilhelmsii C. Koch	0.78	0.92	1.70
Anthemis altissima L.	0.60	0.84	1.44
Glycyrrhiza glabra L.	0.56	0.46	1.02
Bunium persicum (Boiss.) B.	0.56	0.61	1.17
Fedtsch.			
Salvia macrosiphon Bioss.	0.47	0.53	1.00
Peganum harmala L.	0.04	0.07	0.11
Trigonella foenum - graecum	0.34	0.53	0.87
L.			
Lavandula officinalis Chaix	0.21	0.23	0.44
Rosa damascena Mill.	0.21	0.38	0.59
Mentha L.	0.26	0.15	0.41
Salix babylonica L.	0.26	0.30	0.56
Citrus aurantium L.	0.30	0.30	0.60
Plantanus orientalis L.	0.21	0.38	0.59
Salix excelsa S. G. Gmelin	0.30	0.38	0.68
Ziziphus jujuba Mill.	0.21	0.38	0.59
Coriandrum sativum L.	0.21	0.15	0.36
Myrtus communis L.	0.13	0.15	0.28
Acanthophyllum C. A. Mey.	0.47	0.77	1.24
Trachyspermum ammi	0.56	0.54	1.10
Sprague			
Anethum graveolens L.	0.74	0.84	1.58
Malva neglecta Wallr.	0.43	0.69	1.12
Descurainia sophia (L.) Schur	0.60	0.61	1.21
Fumaria parviflora Lam.	0.78	1.00	1.78
Salvia mirzayanii Rech. f.	0.21	0.23	0.44
&Esfand.			
Alcea L.	0.56	0.69	1.25
Cichorium intybus L.	0.74	0.84	1.58

Salvia hydrangea DC	0 12	0.07	0.20
	0.13	0.07	0.20
Ferula assa - foetida L.	0.74	0.77	1.51
Prangos ferulacea (L.) Lindl.	0.08	0.15	0.23
Rheum ribes L.	0.26	0.38	0.64
Portulaca oleracea L.	0.34	0.46	0.80
Ocimum basilicum L.	0.34	0.53	0.87
Vicia sativa L.	0.08	0.15	0.23
Capparis spinosa L.	0.43	0.53	0.96
Citrullus colocynthis (L.)	0.34	0.46	0.80
Schrad.			
Cassia fistula L.	0.30	0.38	0.68
Astragalus campylanthus	0.43	0.69	1.12
Boiss.			
Medicago sativa L.	0.17	0.30	0.47
Ziziphora tenuir L.	0.26	0.23	0.49
Pistacia atlantica Desf.	0.17	0.23	0.40
Adianthum capillus - veneris	0.39	0.53	0.92
L.			
Areca catechu L.	0.13	0.23	0.36
Eucalyptus L'Hér.	0.21	0.30	0.51
Mentha longifolia (L.) Huds.	0.17	0.30	0.47
Micromeria persica Boiss.	0.52	0.53	1.05
Artemisia aucheri (Boiss.)	0.08	0.15	0.23
Alef.			
Cordia myxa L.	0.13	0.23	0.36
Cotoneaster luristanica Klotz	0.21	0.23	0.44

<b>Table 6.</b> Fidelity Level (FL) values of medicinal plants							
Medicinal plants	Ailment category	Specific ailment	<sup>a</sup> lp	<sup>b</sup> lu	FL		
					Value (%)		
Achillea wilhelmsii C.	Gastro-intestinal	Stomach Pain	35	37	94.59		
Koch	Complaints						
Trachyspermum ammi	Gastro-intestinal	Stomach Pain	31	38	81.57		
Sprague	Complaints						
Thymus daenensis Celak	Gastro-intestinal Complaints	Stomach Pain	30	40	75.00		
Foeniculum vulgare Miller	Gastro-intestinal Complaints	Stomach Pain	27	34	79.41		
Salvia macrosiphon	Gastro-intestinal	Stomach Pain	9	19	47.36		
Bioss Ferula assa - foetida L.	Complaints Gastro-intestinal Complaints	Stomach Pain	9	32	28.12		
Citrullus colocynthis (L.) Schrad.	Gastro-intestinal	Stomach Pain	9	34	26.47		
Bunium persicum	Gastro-intestinal	Stomach Pain	6	13	46.15		
(Boiss.) B. Featsch. Glycyrrhiza glabra L.	Complaints Gastro-intestinal Complaints	Stomach Pain	5	38	13.15		
Mentha L.	Gastro-intestinal Complaints	Bellyache	16	24	66.66		
Pistacia atlantica Desf.	Gastro-intestinal Complaints	Bellyache	14	15	93.33		
Foeniculum vulgare Miller	Gastro-intestinal Complaints	Bellyache	9	34	26.47		
Mentha longifolia (L.) Huds.	Gastro-intestinal Complaints	Flatulence	20	23	86.95		
Mentha L.	Gastro-intestinal Complaints	Flatulence	19	24	79.16		
Trachyspermum ammi Sprague	Gastro-intestinal Complaints	Flatulence	6	38	15.78		
Medicago sativa L.	Gastro-intestinal Complaints	Stomachic	18	20	90.00		

PhOL	Jafaridad	116 (pag 101-119)			
Plantanus orientalis L.	Gastro-intestinal Complaints	Stomachic	8	11	72.72
Citrus aurantium L.	Gastro-intestinal Complaints	Hiccup	17	22	77.27
Coriandrum sativum L.	Gastro-intestinal Complaints	Carminative	10	14	71.42
Ziziphora tenuir L.	Gastro-intestinal Complaints	Diarrhea	8	13	61.53
Adianthum capillus - veneris L.	Respiratory problem	Cough	9	12	75.00
Anchusa italica Retz.	Respiratory problem	Cough	7	40	17.50
Thymus daenensis Celak	Respiratory problem	Cough	5	40	12.50
Trigonella foenum - graecum L.	Respiratory problem	Expectorant	10	14	71.42
Malva neglecta Wallr.	Respiratory problem	Expectorant	6	39	15.38
Citrullus colocynthis (L.) Schrad.	Diabetes	Antihyperglycem ic	31	34	91.17
Capparis spinosa L.	Diabetes	Antihyperglycem ic	6	15	40.00
Thymus daenensis Celak	Diabetes	Antihyperglycem ic	6	40	15.00
Malva neglecta Wallr.	Inflammation and pa	Pectoral pain	13	39	33.33
Anchusa italica Retz.	Inflammation and pa	Pectoral pain	12	40	30.00
Glycyrrhiza glabra L.	Inflammation and pa	Pectoral pain	10	38	26.31
Alhagi pseudalhagi (M. B.) Desf.	Urinary and rectal disorders	Bladder calculi	5	31	16.12
Vicia sativa L.	Dermatology problems	Blue spots	34	35	97.14
Salix excelsa S. G. Gmelin	Dermatology problems	Skin itching	11	16	68.75
Anthemis altissima L.	Oral and dental disorder	Toothache	22	40	55.00
Rosa damascena Mill.	Oral and dental disorder	Gums tonic	13	26	50.00
Cassia fistula L.	Oral and dental disorder	Oral thrush	6	9	66.66
Ferula assa - foetida L.	Infectious and parasitic diseases	Anti-parasitic	12	32	37.50

PhOL	Jafarida	afaridad, et al.		117 (pag 101-119)		
Ferula assa - foetida L.	Infectious and parasitic diseases	Cyst	5	32	15.62	
Thymus daenensis Celak	Infectious and parasitic diseases	Body infection	5	40	12.50	
Thymus daenensis Celak	Cardiovascular diseases	Hyperlipidemia	13	40	32.50	
Citrullus colocynthis (L.) Schrad.	Cardiovascular diseases	Hyperlipidemia	12	34	35.29	
Trigonella foenum - graecum L.	Cardiovascular diseases	Hyperlipidemia	8	14	57.14	
Rosa damascena Mill.	Cardiovascular diseases	Heart tonic	18	26	69.23	
Thymus daenensis Celak	Cardiovascular diseases	Hypertension	8	40	20.00	
Ferula assa - foetida L.	Tumorous diseases	Body Inflation	18	32	56.25	
Citrullus colocynthis (L.) Schrad.	Tumorous diseases	Body Inflation	6	34	17.64	
Portulaca oleracea L.	Hematological diseases	Anemia	38	38	100.00	
Micromeria persica Boiss.	Hematological diseases	Anemia	12	18	66.66	
Portulaca oleracea L.	Hematological diseases	Blood purifier	9	38	23.68	
Lavandula officinalis Chaix	Fever	Febrifuge	7	9	77.77	
Astragalus campylanthus Boiss.	Hair growth stimulant/ antidandruff	Hair Softener	14	17	82.35	
Anchusa italica Retz.	Musculoskeletal disorders	Skeletal pain	6	40	15.00	
Glycyrrhiza glabra L.	Musculoskeletal disorders	Skeletal pain	6	38	15.78	
Glycyrrhiza glabra L.	Musculoskeletal disorders	Fracture	36	38	94.73	
Anthemis altissima L.	Musculoskeletal disorders	Foot Pain	5	40	12.50	
Acanthophyllum C. A. Mey.	Female problems	Emmenagogue	12	17	70.58	

PhOL
------

Jafaridad, et al.

118 (pag 101-119)

Cordia myxa L.	Constipation	Hydragogue	5	7	71.42
Eucalyptus L'Hér.	Ear, nose, throat disorder (ENT)	Rhinorrhea	13	19	68.42
Peganum harmala L.	Ear, nose, throat disorder (ENT)	Low Hearing	12	12	100.00
Astragalus campylanthus Boiss.	Ear, nose, throat disorder (ENT)	Sore throat	9	17	52.94
Alhagi pseudalhagi (M. B.) Desf.	Liver diseases	Jaundice	9	31	29.03
Cotoneaster luristanica Klotz	Liver diseases	Cholecystagogue	5	6	83.33
Anthemis altissima L.	Nervous system	Nerves tonic	40	40	100.00
Micromeria persica Boiss.	Nervous system	Nerves tonic	15	18	83.33
Salix babylonica L.	Nervous system	Nerves tonic	15	18	83.33
Anchusa italica Retz.	Nervous system	Nerves tonic	14	40	35.00
Micromeria persica Boiss.	Nervous system	Depression	16	18	88.88
Acanthophyllum C. A. Mey.	Nervous system	Sciatica	9	17	52.94
Alhagi pseudalhagi (M. B.) Desf.	Renal diseases	Renal calculi	18	31	58.06
Alhagi pseudalhagi (M. B.) Desf.	Renal diseases	Renal Pain	14	31	45.16
Anchusa italica Retz.	Cold	Common cold	37	40	92.50
Malva neglecta Wallr.	Cold	Common cold	36	39	92.30
Eucalyptus L'Hér.	Cold	Common cold	16	19	84.21
Anthemis altissima L.	Cold	Common cold	15	40	37.50
Glycyrrhiza glabra L.	Cold	Common cold	15	38	39.47
Thymus daenensis Celak	Cold	Common cold	9	40	22.50



Figure 1. Location of study area, Darab, in Iran Map



Figure 2. Families of the plants with their frequencies