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Agrobiodiversity of plant genetic resources in Savadkouh/Iran with emphasis on plant uses and socioeconomic aspects

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Dedicated to my wife, Maryam and my daughter, Ainaz

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List of acronyms and abbreviations

BC	Before Christ
FAO	Food and Agriculture Organization
FROI	Forest and Range Organization of Iran
IUCN	International Union for Conservation of Nature and Natural Resources
Mt.	Mountain
NBSAP	National Biodiversity Strategy and Action Plan Secretariat
PGR	Plant Genetic Resources
UNEP	United Nations Environment Programme
WCMC	World Conservation Monitoring Centre

1Introduction

A study on the agrobiodiversity of cultivated plant genetic resources with emphasis on plant uses and socioeconomic aspect of farmers was conducted in northern Iran. This study is comprised of four major parts.

The first part consisted of the collection of plant genetic resources in the research area. This collection was done in four sub-areas based on altitudes. The main goals of this part were collection of local seeds and some data on the ethnobotany of cultivated plants. The selected accessions of collected seeds were sown later in the greenhouse of the University of Kassel in Witzenhausen, Germany to classify and conduct the preliminary evaluation. Results of this study show genetic erosion with the disappearance of the local landraces and many indigenous varieties being replaced by new cultivars. The area is an important refuge for local landraces as well as domestication of wild plants through local agricultural systems.

The second part of the study explored the uses of the wild and neglected fruit tree and shrub species in the research area to obtain a better understanding of the knowledge of rural populations. The interactions between wild and cultivated plants in the area were of special interest. The results of this investigation show a dependence on wild trees and shrub species as sources of local foods and medicines.

The third section investigates the relationship between socioeconomic aspects of farmers with plant biodiversity in homegardens. Homegardens play a crucial role in the conservation of plant diversity and are a suitable place for the cultivation of fruits and vegetables that are mainly used for home consumption, and the surplus can be sold in local markets to generate income. Six types of homegardens were identified by cluster analysis based on agroecologic and socioeconomic variables.

The final part of study was a checklist of cultivated plants to characterize the state of plant genetic resources in the research area. The checklist contains accepted botanical names, synonyms, family names, local names, part and plant uses and some additional notes mainly on the present status of these plants.

2 State of the art

Plant biodiversity represents the primary source for food, feed, shelter, medicines and many other products and means that make life on Earth possible and enjoyable (WCMC 1992, UNEP 1995).

Plant genetic resources are plant materials, reproduced generatively or vegetatively, with current or potential value (for nutrition, agriculture and forestry), including landraces, related wild forms and species and specific genetic material of cultivated plants (FAO 1996).

As the world population continues to increase, and the arable land continues to decrease, the need for high productive crop plants becomes more urgent. Of the estimated 270.000 higher plant species, the total number of botanical plant species cultivated as agricultural or horticultural crops is estimated at almost 7.000 (Hammer 1995, Hammer et al. 2003a). However, only about 30 are currently used as major food crops. The shift to monoculture farming has meant a loss of genetic variation. The conservation of these variants is the purpose of a discipline known as genetic resource conservation. It was important to note that the development of modern crop forms

would not have been possible if the earlier landraces had not been available to plant breeders.

The general trend of the past decades has been the release and cultivation of improved cultivars of many major and minor crop species. These cultivars, usually derived from a limited number of elite lines, tend to be uniform. This, together with large-scale cultivation of such genetically uniform cultivars, has increased the genetic vulnerability of many major agricultural crop species, often with disastrous consequences. An often quoted-example is the Irish potato famine of 1840s, when the potato crop in Ireland was virtually destroyed as the potato varieties grown then had no resistance to the leaf blight disease. Similarly the outbreak of rice brown spot disease in Bengal area in 1943, aggravated by typhoons, contributed to serious famine in India (Council 1972). In 1970, as a result of southern corn leaf blight, corn production decreased by about 25% in the southern states of the USA (Anon 1973). Vulnerability due to increasing uniformity continues and several potential disasters may be brewing right now. For example, several important traditional crops of Oceania are highly threatened due to their narrow genetic base (Lebot 1992). In 1993, taro leaf blight destroyed about 95% of the taro crop in Samoa, where it is the major staple food. The vineyards in California are being invaded by new biotype of phylloxera, the aphid relative that affects the root system of vines. Since more than 70% of wine grapes in Napa and Sonata counties are grafted on susceptible rootstock, the grape crop is seriously threatened and the possibility of the spread of the disease is considered very likely (Granett et al. 1991).

Estimations show that about 1.000 crop plant species are in endangered (Hammer et al. 2001, Hammer 2004). Hammer and Khoshbakht (in print a) applying the IUCN criteria and Red List Categories to agricultural and horticultural plants (excluding ornamentals) has been present about 200 examples of such endangered species.

Landraces are rapidly being replaced by modern cultivars due to the ever-increasing demand for increased yields from limited land. Although these traditional local races have comparatively low yields, they are always endowed with certain highly desirable traits, such as stress and disease tolerance and other adaptive features (Gautam et al. 2000).

The yield levels of many crops have reached a plateau due to the narrow genetic base of these crops. Although, the results of some surveys (Brown 1983, Chang 1994 Smale 1997) indicate that the genetic base of several important crops has begun to increase over the years, breeding programs of many important crops continue to include only a small part of genetic diversity available, and the introduction of new and improved cultivars continues to replace indigenous varieties containing potentially useful germplasm.

To widen the genetic base for further improvement, it is necessary to collect, characterize, evaluate and conserve plant biodiversity, particularly in local, underutilized and neglected crop plants.

The beginning of floristic studies in Iran can be dated to 1684 when the German Physician and traveller Engelbert Kaempfer (1651-1716) coming via the southern Caucasus, visited Rasht, Qazvin, Shiraz and finally, the Persian Gulf coast. Upon his return to Europe, he took with him a large collection of exotic plants gathered in the said areas and elsewhere in Asia. After him, until 1977, about 41 European botanists or amateur plant collectors' collected Iranian plant species and their collections greatly enriched European herbariums with plants from Iran, Southwest Asia, Middle and Near East. It was mainly on the basis of these oriental collections brought back to Europe by Western travellers that the famous Swiss botanist Edmond Boissier

composed his *Flora Orientalis*. This monumental work, published in 5 volumes in 1867-88, describes a great number of plants from Egypt, Turkey, India and the Iranian highlands, including 5.000 new species.

Nicolay Ivanovich Vavilov was a plant geographer who explored the major agricultural production regions of the Russia and the world. He organized and conducted over 100 collecting missions including to Iran. In 1916, he made an expedition into Asia for research on cultivated plants, covering the territory of the northern half of Iran and the area adjacent in Soviet Central Asia. He had mentioned that the Gilan, an area adjacent to Mazandaran province, was one of the main areas for growing rice in Iran. In this area several tens of thousands of hectares, are devoted to the intensive cultivation of rice (Vavilov 1997). In the 20th century, another great European botanist, Karl Heinz Rechinger from Austria, has studied, with his numerous collaborators, the flora of the Iranian geobotanical area, e.g. modern Iran, West Pakistan, Turkmenistan, Republic of Azerbaijan, eastern Turkey, and northern Iraq. The results of this colossal joint work have been published under the title of *Flora Iranica* since 1963.

Botanical studies and collections in Iran mainly have been focussed on wild species (Parsa 1948-1988, Ghahreman et al. 1981, Léonard 1982-1992, Klein 1994, Ghahreman and Attar 1996, Ghahreman and Attar 1998, Akhani 1998, Assadi 1988-2003 and Frey et al. 1999).

Plant genetic resource studies in Iran are few (Vavilov 1916, Kuckuck 1956 and Damania et al.1993) and usually ignore or are included as a small part of botanical studies (Assadi 1988-2003, Shokri and Safaian 1993). Collectors and botanists also trend to focus narrowly on particular species and are less interested in cultivated crops.

To continue these studies and in order to study the agrobiodiversity of plant genetic resources with emphasis on plant uses and socioeconomic characters of farmers, the Savadkouh area in northern Iran was selected for this study. The area is an important evolutionary center for wild fruit trees and the local agricultural system plays an important role in the conservation, domestication and use of plant genetic resources and their wild relatives.

To our knowledge, there is no study on plant genetic resources in this area; therefore, to fill this gap in the literature, this study was conducted with the following objectives.

21 Objectives

The objectives of this study were:

- To identify and document the plant genetic resources of the research area.
- To obtain a better understanding of the knowledge of rural populations on wild neglected fruit tree and shrub species, and identify interactions between wild and cultivated plants in the research area.
- To conserve and protect the genetic resources and to contribute to a sustainable use of natural resources.
- To evaluate homegardens' contribution to the conservation, maintenance and domestication of plant genetic resources and wild relatives.
- To develop methods for analysing ethnobotanical, socioeconomic, sociocultural and gender issues that affect the distribution of species.

- To classify homegardens according to socioeconomic and agroecologic variables.

Furthermore, this survey focuses on the identification and documentation of plant genetic resources, evaluates the use of wild neglected fruit trees and shrub species, and classifies homegardens in terms of socioeconomic and agroecologic variables.

This provides benefits to both scholars and scientists with a framework for further research in other areas of Iran.

The following research questions were derived from the above-mentioned objectives of the survey.

22 Research questions

The main questions of this study were:

- Which plant species are cultivated in the research area?
- What are the wild neglected fruit tree and shrub species?
- What are the uses of these species?
- What are the destinies of the products of these species?
- What are the different types of homegardens?
- What are the benefits of homegardens for farmers?
- How is the influence of local agricultural systems on the evolution of crop plants and wild relatives?

23 Materials and methods

231 Study area

2311 About Iran

23111 Geographical location and landscape

Iran comprises a land area of 1.64 million km² in the Middle East. It lies in the northern part of the temperate zone, between latitudes 25° 03' to 39° 47' north and longitudes 44° 14' to 63° 20' east. It is bordered on the north by Armenia, Azerbaijan, Turkmenistan, and the Caspian Sea (the Caucasus Mountains, Middle Asian natural regions); on the east by Afghanistan and Pakistan; and on the south by the Persian Gulf and the Gulf of Oman, the Strait of Hormuz, and on the west by Iraq and Turkey (Anatolian and Mesopotamian regions). The existence of the high mountains in the north, the Zagros Range in the west and southwest and the eastern mountains of Iran, which surround the Iranian plateau, provide Iran with rugged mountains and spectacular terrain. In both north and south of the country, are wide plains, which produce the low coastal lands (the Caspian sea –26 m below sea level), (Firuz 1974). The height of some of the mountains is over four thousand meters.

The main highlands are comprised of four distinct mountainous areas: 1) Alburz in the north (Mt. Damavand, 5.628 m; Mt. Takht-e-Soleyman, 4.643 m); 2) Kopet-Dagh and north Khorasan ranges in the north-east (Mt. Hezar-Masjed, 3.040 m; Mt. Binaloud, 3.211 m); 3) Zagros in the west (Mt. Dena, 4.409 m; Mt. Zard-Kuh, 4.221

m) and 4) Jebal Barez and the Baluchestan mountains in the central to southeast (Mt. Bahraseman, 3.886 m; Mt. Pelvar, 4.233 m; Mt. Jupar, 4.135 m; Mt. Lalehzar, 4.351 m; Mt. Taftan, 3.941 m). In addition, the northwest Iranian mountainous area (Mt. Sabalan, 4.811 m; Mt. Sahand, 3.707 m) and the central Iranian mountainous area (Mt. Karkas, 3.895 m; Mt. Shirkuh, 4.055 m) form more or less distinct highlands in the inner part of the country (Zehzad et al. 2002).

Seven desert plains and depressions give the landscape a completely different appearance: Dasht-e Kavir in Central Iran, Dasht-e Lut desert, Sistan and Jazmurian depressions in the southeast, Khuzestan plain in the southwest, Moghan steppe in the northwest and the Turkman-Sahra steppe in the northeast.

The six main watershed areas are the Caspian Sea (177.000 km²) in the north, the Persian Gulf and the Sea of Oman (430.000 km²) in the south, Urmia (53.000 km²) in the northwest, Markazi (831.000 km²) in the central region, Hamoun (106.000 km²) in the east and Sarakhs (44.000 km²) in the northeast (NBSAP Secretariat 2000).

Topographic characteristics have given rise to five biomes (NBSAP Secretariat 2000) namely: Irano-Touranian (ITP), arid and semi-arid plains and deserts; Irano-Touranian (ITM), arid and semi-arid mountains; Zagrosian (Z), semi-arid zagros mountains; Hyrcanian (H), humid and semi-humid Arasbaran and Hyrcanian mountains and the Caspian plain; Khalijo-Ommanian (KO), dry southern coastal plains with high humidity.

The Hyrcanian biome in Iran covers approximately 50.000 km^2 and is located within the Iranian provinces Gilan, Mazandaran and Golestan. The region extends throughout the south coast of the Caspian Sea – which was called the Hyrcanian Ocean in antiquity – and the northern part of Iran. It has high production capacity due to a humid temperate climate and suitable soil. Because of extensive concentration of human life and their activities in the lower altitudes, large parts of the lowland forests have been deforested into human settlements, cultivated areas, industry, etc. Hyrcanian forests extend for 800 km in length and the main tree and shrub species are: *Fagus orientalis* Lipsky, *Carpinus betulus* L., *Quercus castaneifolia* Pantoc., *Buxus hyrcana* Pojark., *Parrotia persica* C.A.Mey., *Pterocarya fraxinifolia* Spach, *Alnus subcordata* C.A.Mey., *Zelkova carpinifolia* Dippel, *Diospyros lotus* Blanco, *Carpinus orientalis* Mill., *Fraxinus excelsior* L., *Tilia begoniifolia* Chun & Wong and *Carpinus schuschaensis* H.Winkl. (Forest and Range Organization of Iran 1986, 1997).

23112 Climate and rainfall

Iran is situated in the global arid zone, and about 85 percent of the land area is classified as arid or semi-arid climate. The moderately scant annual precipitation falls from October to April and the spatial distribution of precipitation is very uneven. In some parts total annual precipitation is less than 50 mm while annual precipitation exceeds 1.800 mm in the northern parts of the country. The average annual temperature increases from 10 °C (in the northwest) to 25-30 °C (in the southeast), and the northern and southern shores have diverse climatic conditions compared with the central and mountainous regions. Both latitude and altitude have a major influence on climate in the various regions. The Alburz and Zagros Mountain chains trap the humidity and air currents of the Caspian Sea and the Mediterranean climate preventing their from penetration to the inner parts. The country features three main climatic zones (NBSAP Secretariat 2000).

- Arid and semi-arid regions of the interior and far south, which are characterized by long, warm and dry periods, sometimes lasting over seven months. The annual precipitation in such regions varies between 30-250 mm.
- Mediterranean climate regions, mainly in the western Zagros Mountains, the high plateau of Azerbaijan, and the Alburz Mountains, which are characterized by warm, dry summers and cool damp winters, with annual rainfall between 250-600 mm.
- Humid and semi-humid regions, mainly in the Caspian Sea, but also in west Azerbaijan and the southwest Zagros, with an annual precipitation of 600-2.000 mm.

Although most parts of the Iran can be classified as arid and semi-arid, the country has wide spectrum of climatic conditions and Sabeti (1997) divided them into 14 bioclimatic types based on Emberger's method. Average annual precipitation in Iran is about 275 mm with distribution shown in Table 1 (Pazira and Sadeghzadeh 1999, Massoumi 1984).

Table 1: Distribution of precipitation in Iran (Pazira and Sadeghzadeh 1999).

Annual precipitation (mm)	Recipient area	
	(Km²)	(%)
<50	100.000	6
50-100	285.000	17
100-200	465.000	28
200-300	370.000	23
300-500	280.000	17
500-1000	130.000	8
>1.000	18.000	1

23113 Flora and fauna

Most of Iran is located in the Palaearctic realm and is considered the center of origin of many genetic resources of the world, including many of original strains of commercially valuable plant species such as *Diospyros lotus* L., *Spinacia oleracea* L., *Amygdalus persica* L. and *A. vavilovii* M. popov et Vved. (Zeven and de Wet, 1982). The origin of bread wheat (*Triticum aestivum* L.) is Transcaucasia and south of the Caspian Sea in Iran (Dvorák et al. 1998).

The gene centers theory or centers of diversity was firstly developed by Vavilov (1927). The Vavilov's theory has been further developed by Harlan (1971), who defined centers and non-centers in order to differentiate "regions of origin" from secondary regions, populated at a later date with the species. A region is designated as a gene center for a species if a large portion of the genetic diversity within the species can be found here.

The rich flora and fauna of the Iran is one of the most fascinating in southwest Asian. Today one still finds humid forests in the south Caspian costal plain and northern slopes of the Alburz Mountains. Drought adapted woodlands and shrublands cover the mountains in the west and northeast of Iran. The subalpine zones of the Alburz and Zagros mountains are dominated by mountain steppes, which are characterized by thorn-cushion formation or grassland. Most of arid and semi-arid parts of the country and the lower playas are occupied by *Artemisia* steppe or various kinds of halophytic and psammophytic vegetation types. The coastal regions on the Persian Gulf, are characterized by *Acacia* and *Prosopis* semidesert shrublands and mangroves (Frey and Probst 1986, Freitag 1986, Léonard 1982-1992, Akhani and Ghorbanli 1993, Akhani 1998). The varied climatic, topographic and edaphic contrasts between Iranian plateau and the surrounding highlands have resulted in a rich flora and high evolutionary potential. The Iranian vascular plant flora comprises approximately 10.000 species, with about twenty percent of them being endemic based on the published figures and an estimation of the forthcoming volumes of Flora Iranica (Rechinger 1963-2001, Akhani 1994).

Currently, there are 90 million hectares of rangeland (54.8 % of the area of country), 12.4 million hectares of forests (7.5 % of the area of country), 5.3 million hectares of protected areas (3.2 % of the area of country), 1.9 million hectares of wildlife refuges (1.2 % of the area of country) and 1.3 million hectares of national parks (0.8 % of the area of country) (NBSAP Secretariat 2000).

High diversity in vegetation and habitat conditions has also resulted a high diversity of fauna. Studies confirm the presence of 160 species of mammals (Ziaei 1996), over 500 species of birds and 164 species of reptiles (Zehzad et al. 2002). Animals such as maral (*Cervus elaphus*), Persian fallow deer (*Cervus dama*), brown bear (*Ursus arctos*), black bear (*Selenarctos thibetanus*), cheetah (*Acinonyx jubatus*), leopard (*Panthera pardus*), onager (*Equus hemionus*), gazelle (*Gazella subgutturosa*, *G. durcas*) and the marsh crocodile (*Crocodylus palustris*) are outstanding examples that showing the habitat, ecosystem and animal diversity in Iran.

23114 Agriculture

Plant remains in **Ali Kosh**, Deh Luran Plain, Khuzistan (7.000 BC), **Tepe Sabz**, Deh Luran Plain, Khuzistan (5.500-5.000 BC) (Helbaek 1969), **Tepe Hasanlu**, Solduz Valley (Tosi 1975) (6^{th}-4^{th} millennia BC) and **Tepe Yahya** and adjacent sites (Costantini and Costantini-Biasini 1985) (late 6^{th} millennium BC to 5^{th} millennium BC) show a long history of agriculture in Iran. The two villages of Jarmo and Sarabin, respectively located within Iran and Iraq, have been identified as the oldest of the region, where people started cultivating land about 10.000 years ago (Farshad 1997).

In general, Iran is mountainous and semi-arid country and mountains and highlands cover more than half of total area. Of a total 37 million hectares of arable land, 17 million hectares are irrigated and 20 million hectares rain-fed.

Climatic conditions of Iran are mostly typical of arid and semi-arid regions. Nevertheless, the country has a wide spectrum of climatic conditions. As such, it is no surprise that both tropical and cool season crops are grown and produced in Iran (e.g. citrus, dates, pistachio sugarcane, rice, apples, cherries, walnuts, and apricots). However, the most extensive cultivated area is devoted to wheat and barley, which are the main sources of staple food. Wheat alone covers about one third, and fruits cover nearly one fifth of the total irrigated land of Iran.

Both systems of irrigated and rain-fed farming (dry farming) are practiced in different parts of the country while the area devoted to each system varies considerably depending on agro-climatically conditions. Rain-fed agriculture and dry farming are most successful in western and northwest of Iran, as well as the sloping lands in the Caspian coast. In other parts of the country, dry farming is also practiced in hilly areas, but the yields obtained are limited. In the central plateau, as well as the southern plains and the southern coastal areas of Iran, crop production is normally possible only under irrigation.

2312 About Savadkouh (research area)

The area of Savadkouh with 2.078 km² is located near in southern Caspian Sea within the central part of the Hyrcanian biome. This area, with 1.700 mm annual rainfall and mean annual temperature of 17 Cº, extend between latitudes 36° 01' to 36° 42' north and longitudes 52° 46' to 53° 32' east. From a climatic perspective, the area can be divided into two zones: 1) moderate Caspian weather with hot and humid summers and mild and humid winters, especially in low lands and 2) cold mountainous weather with long freezing winters and short cool summers, especially in the mountains.

The Alburz mountain range surrounds the coastal plain like a high wall. Due to permanent breezes of the Caspian Sea and local winds from the southern and eastern coasts of the sea, sandy hills that have caused the appearance of a low natural barrier between the sea and the plain have formed.

The nature of this area is under the influence of geographical characteristics, distance from sea, local and regional wind currents, and vegetation. Broadleaf forests cover the main part of area and agriculture and husbandry are the main activities in rural parts. Diversity in topography is connected with few flat lands; therefore, farming and agricultural activities are limited to the small fields and homegardens. Local agricultural systems play an important role in the generation of income as well as the conservation of species and domestication of wild crop relatives. Plant diversity in these microelements highly depends on ecologic conditions, as well as socioeconomic conditions of farmers.

The rural population of Savadkouh use wild fruit trees and shrubs both for nutrition and medicinal purposes. There are considerable interactions between wild and cultivated plants in the area.

232 General methodology

Several preliminary missions and visits were carried out in the Savadkouh area in the northern Iran in January to June 2003. These surveys were followed by intensive fieldwork in April / May 2004 in this area (Figure 1a and 1b).

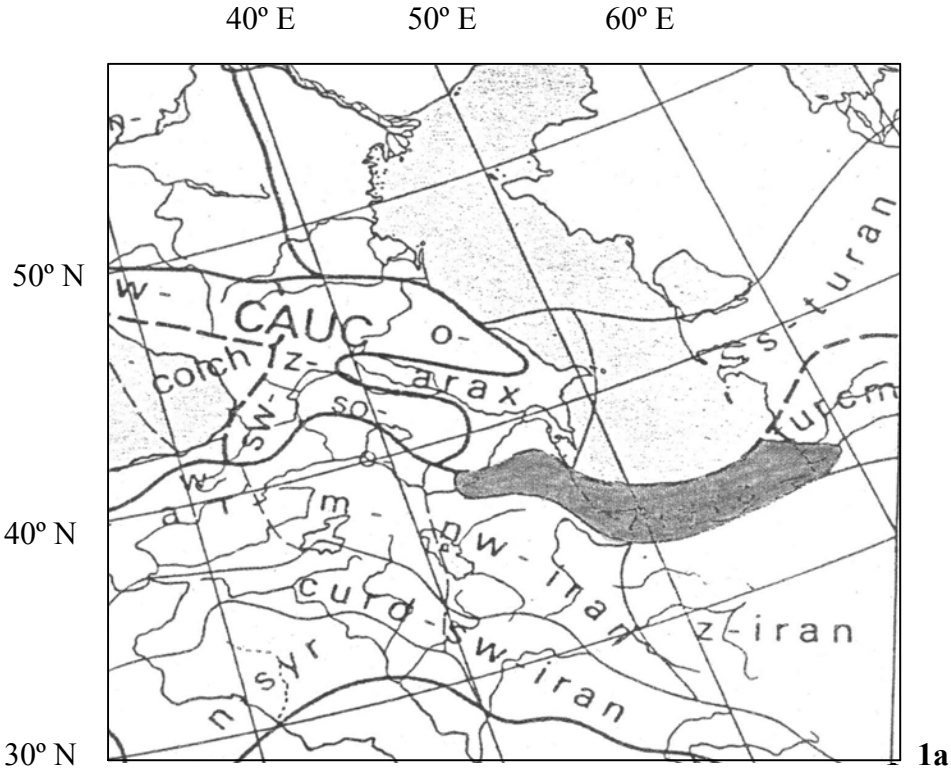

Figure1: Geographical location of research area. 1a) Geographical position of the Hyrcanian biome (dark grey part, after Meusel and Jäger 1992), 1b) The map of Iran, showing the Hyrcanian biome in Iran and the Savadkouh area.

Agrobiodiversity in this area highly depends on altitude, and therefore four different sub-areas were selected. These sub-areas can be classified as lower than 500 m, between 500-1000 m, between 1000-1500 m and higher than 1500 m above sea level.

In each sub-area, five sites (totally twenty sites) were randomly selected and investigated (Figure 2).

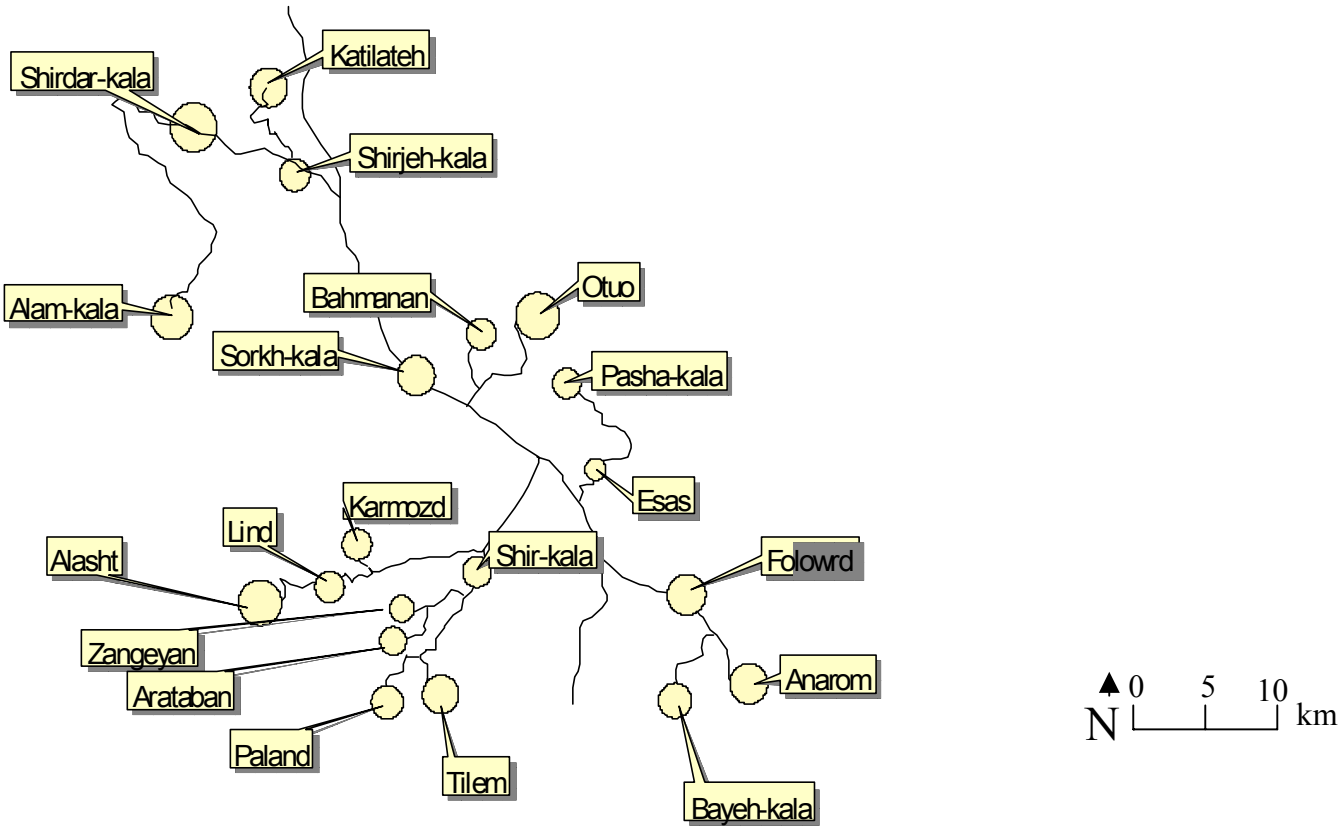

Figure 2: Investigation sites in Savadkouh area.

The longitude, latitude and attitude of each site were determined by a handheld GPS system. These geographical characteristics are shown in Table 2.

Table 2: Geographical characteristics of sites in different sub-areas.

Sub-areas	Sites	Longitude (N) ..° ..′	Latitude (E) ..° ..′	Altitude (m asl.)
Sub-area1	Shirdar-kala	36 23	42 45	190
	Kati-lateh	36 21	52 51	280
	Shirjeh-kala	36 19	52 52	280
	Alam-kala	36 14	52 49	345
	Sorkh-kala	36 12	52 56	400
Sub-area 2	Outo	36 04	53 01	570
	Bahmanan	36 13	52 59	610
	Pasha-kala	36 12	53 02	612
	Shir-kala	36 19	52 52	700
	Esas	36 09	53 04	900
Sub-area 3	Folowrd	36 04	53 08	1160
	Arataban	36 03	52 56	1200
	Zangeyan	36 04	52 56	1300
	Karmozd	36 03	52 53	1320
	Anarom	36 02	53 10	1460
Sub-area 4	Tilem	36 02	52 57	1550
	Paland	36 10	52 57	1550
	Alasht	36 04	52 50	1670
	Bayeh-kala	36 02	53 07	1800
	Lind	36 05	52 53	1890

At each site, five cases (homegardens and fields) were randomly selected. The cases selected were alongside the sites with proper distance concerning to size of the village. The small roads followed also to different orientations of sites to cover the area as completely as possible. Complete information on socioeconomic aspects, diversity of cultivated plant species (except ornamental plants) and uses of them were collected through direct observation of homegardens and fields as well as interviews with farmers. The applicability of the questionnaire was pre-tested with some farmers and was modified accordingly. It was revised to clarify, add or drop specific questions and ensure that the average duration of a single interview did not exceed 30 min. The questionnaire was divided to two sections. The first focused on the diversity of cultivated plants and their uses, and the second dealt with information on the family structure and socioeconomic aspects of the farmer. The interviews were conducted in Farsi and comprised either open or closed questions. In addition to the data recorded directly by interviews, further information was registered from informal market surveys, local specialists, and rural experts.

This data was compiled with vernacular names taken from the Iranian literature e.g., Hosayn Golegolab, *Gia Rahnema-ye giyahi* (1961), Ali Zargari, *Giahan-e darui* (1976-1980), Valiollah Mozaffarian, *A Dictionary of Iranian Plant Names* (1998) and personal investigations.

The collection of plant genetic resources, the study of uses of wild neglected fruit tree and shrub species, interdisciplinary analysis of homegardens and the checklist of cultivated plant species each comprise different parts of this study. The precise methodology of each part will be presented in more detail in particular part.

3 Results

31 Collection of plant genetic resources*

311 Introduction

Iran belongs to the Southwest Asiatic Center of Origin as proposed by Vavilov (1927). Therefore, a large amount of variation in plants and wild relatives can be expected there. Traditional agriculture and suitable climatic conditions in Savadkouh (study area) resulted in proper refuge for landraces and local varieties. This area is also a suitable region for domestication and conservation of wild plants.

Plant genetic resource studies in Iran have only covered a small part of this country and mainly focued on cereals (Vavilov 1916, Kuckuck 1956, Damania et al. 1993) and sometimes are small part of botanical studies (Assadi 1988-2003, Parsa 1948-1988).

Due to lack of pervious collection in the research area and fast replacement of the presently available local plant genetic resources with released high yielding varieties, the collection of these materials should be receive priority attention. Therefore, an expedition was conducted to collect seed samples of cultivated crop genetic resources together with data on ethnobotany.

312 Methodology

In order to identify and document cultivated plant genetic resources to collect some local seed samples, a collection survey was carried out in different sub-areas of the study area. In each sub-area five sites were visited and the primary sources of the collected accessions were homegardens and farmer's fields. A total of eighty farms and homegardens (twenty in each sub-area) were explored. Data on ethnobotany and local uses of plants were gathered through interviews with farmers as well as local specialists.

The accessions of collected seeds were sown later in greenhouse of the University of Kassel in Witzenhausen, Germany for later classification and preliminary evaluation.

After classification and preliminary evaluation the seeds will be included into the Iranian genebank.

313 Results

Altogether, the collections comprise 172 accessions. A detailed list of the collected material and their vernacular names are reported in Table 3.

* This part of the study was submitted as an article in Plant Genetic Resources Newsletter (PGRN of FAO/IPGRI is not just a Newsletter, but a peer reviewed journal). (Khoshbakht et al. submitted).

Table 3: Number of accessions collected on the Savadkouh / Iran.

Species	Vernacular name	Collecting sub-area				
		1	2	3	4	Total
CEREALS						
Hordeum vulgare L.	Jow	-	2	-	2	4
Oryza sativa L.	Berenj	5	6	3	-	14
Setaria italica (L.) P. Beauv.	Gavras italiaei	1	-	-	1	2
Sorghum bicolor (L.) Moench	Sorghum	2	1	-	-	3
Sorghum halepense (L.) Pers.	Sorghum	2	-	-	-	2
Triticum aestivum L.	Gandom	2	2	1	2	7
Zea mays L.	Zorat	3	1	-	-	4
Total		***15***	***12***	***4***	***5***	***36***
PULSES						
Cicer arietinum L.	Nokhod-e abgoshti, Nokhod-e shafid	-	-	-	1	1
Lens culinaris Medicus	Adas, Marji	1	-	-	-	1
Phaseolus coccineus L. var. *albiflorus* (DC.) Bailey	Lobiya	2	1	-	-	3
Phaseolus coccineus L. var. *coccineus*	Lobiya-e gol	-	1	-	-	1
Phaseolus lunatus L.	Lobiya	1	1	-	-	2
Phaseolus vulgaris L.	Lobiya	17	5	3	2	27
Pisum sativum L.	Nokhod-e shabz, Nokhod-e farang	1	-	-	-	1
Vicia faba L.	Baghla	1	2	1	-	4
Vigna unguiculata (L.) Walp.	Lobiya-e Chashmbolboli	2	-	-	1	3
Total		***25***	***10***	***4***	***4***	***43***
VEGETABLES						
Allium cepa L.	Peiyaz	1	-	-	-	1
Allium paradoxum (M.B.) Don	Alezi	-	-	1	-	1
Allium sp.	Taree	1	3	-	-	4
Anethum graveolens L.	Shvyt, Shbyt	2	1	-	1	4
Beta vulgaris L.	Choghondar-e ghand	1	2	-	1	4
Brassica rapa L.	Shalgham	1	-	-	-	1
Capsicum annuum L.	Felfel-e dolmei	-	1	-	-	1
Coriandrum sativum L.	Gheshniz	2	2	-	2	6
Cucumis sativus L.	Khiyar	1	3	-	2	6
Cucurbita pepo L.	Kadow-e mosamaei	6	6	3	3	18
Daucus carota L.	Hawich	2	1	-	-	3
Eryngium sp.	Aweiyeh	-	2	-	-	2
Lactuca sativa L.	Kahow	1	1	-	-	2

Lepidium sativum L.	Shahi, Tartizak	4	-	-	1	5
Lycopersicon esculentum Mill.	Gorjehfarangei	1	1	-	-	2
Ocimum basilicum L.	Rihan	2	1	-	1	4
Petroselinum crispum (Mill.) Nym. ex A.W. Hill	Jafari	2	1	-	1	4
Raphanus sativus L.	Torobche, Torob	2	2	-	-	4
Spinacia oleracea L.	Esfenaj	3	2	-	2	7
Solanum melongena L.	Badenjan, Bademjan	1	-	-	-	1
Total		***33***	***29***	***4***	***14***	***80***
OTHER SPECIES						
Brassica napus L.	Colza	-	1	-	-	1
Helianthus annuus L.	Gol-e aftabgardan	1	1	1	1	4
Heracleum persicum Desf. ex Fisch., C.A.Mey. & Avé-Lall.	Golpar	-	-	1	-	1
Sesamum indicum L.	Konjed	1	-	-	-	1
Trifolium repens L.	Shabdar	1	-	-	-	1
Trigonella foenum-graecum L.	Shanbalileh	3	1	-	1	5
Total		**6**	***3***	***2***	***2***	***13***
CUMULATIVE TOTAL		***79***	***55***	***14***	***25***	***172***

3131 Collection in sub-area 1

In this sub-area 15 accession from cereals, 25 from pulses, 33 from vegetables and 6 from other species were gathered.

Rice is cultivated primarily for the grain, which forms an essential part of the diet in the research area. Grains are quite nutritious when not polished. After threshing, the rough rice is transported to mills for processing into polished rice through a series of operations that free it from the hull, germ and bran. Processing of rice for local use is still carried out in small workplaces. Rice is used in various forms, cakes, soups and breakfast foods. The seeds are used in folk medicine for breast cancers and stomach indurations. The husks are burned and used as fuel or used as packing material for fragile goods and for making lightweight concrete. The rice straw is mixed with other fodders is used for livestock. Locally it is also used for making sacks, mats and hats.

Several local varieties of rice (*Oryza sativa* L.) cultivated in this area are Tarum mahali, Sang tarum, Nemat, Daneh deraz mahali, Zarek, Binam, etc. (Figure 3). The cultivation of these varieties is limited and often substituted with new inbred cultivars by farmers. Tropical and subtropical fruit trees such as *Citrus sinensis* (L.) Osbeck*, Citrus aurantifolia* (Christm.) Swingle*, Citrus aurantium* L.*, Citrus limon* (L.) Burm. f. and *Citrus reticulata* Blanco have the highest percent of land used after rice, because of semitropical conditions in the low lands (data from survey). The fruits are used mostly as table fruits and also for juice preparation. Petals of sour orange and fruit bark of orange are used into preparation of marmalade, which locally named "Moraba bahar narenj" and " Moraba post portghal" respectively. The dried petals of sour orange also used as an aromatic matter especially when mixed with black tea.

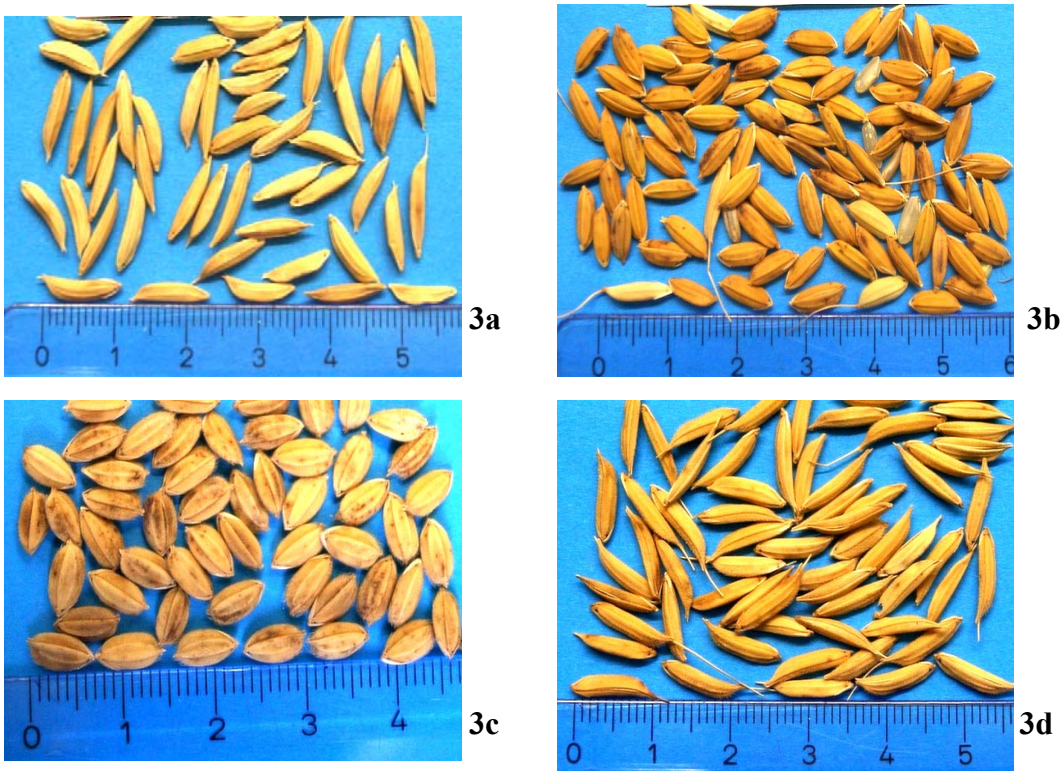

Figure 3: Local varieties of rice. 3a) Deraz mahali, 3b) Binam, 3 c) Zarek, 3d) Tarum mahali.

Setaria italica (L.) P. Beauv. (Figure 4), formerly used in a wide range of local cuisines, is a rare crop in this area, because of migration of farmers and changes in dietary habits. The grains were boiled like rice, cooked into porridge, or after grinding baked into flat bread, we found to now be grown for cage-birds and poultry only in limited areas.

Figure 4: Seeds of *Setaria italica*, a rare crop in the research area.

Beans, peas, and lentils are known as pulses. They are the seeds of plants belonging to the family of Fabaceae, which gets its name from the characteristic pod or legume that protects the seeds while it are forming and ripening. They are rich in protein,

carbohydrates and fibre. They are also important sources of some B vitamins. Fresh pulses contain vitamin C, but this declines after harvesting and virtually all is lost when the pulses are dried. They are used in different local foods and can be eaten fresh or dried. One advantage of dried pulses is that they will store very well for long periods if kept in a dry conditions.

Several accessions of *Phaseolus vulgaris*, three accessions from *Ph. coccineus* var. *albiflorus,* only one accession from *Ph. coccineus* var. *coccineus* and two accessions from *Ph. lunatus* were collected from research area especially in the first sub-area (Figure 5). Whereas, *Ph. vulgaris* is a very common crop, *Ph. coccineus* var. *coccineus* and *Ph. coccineus* var. *albiflorus* are rare crops in the research area.

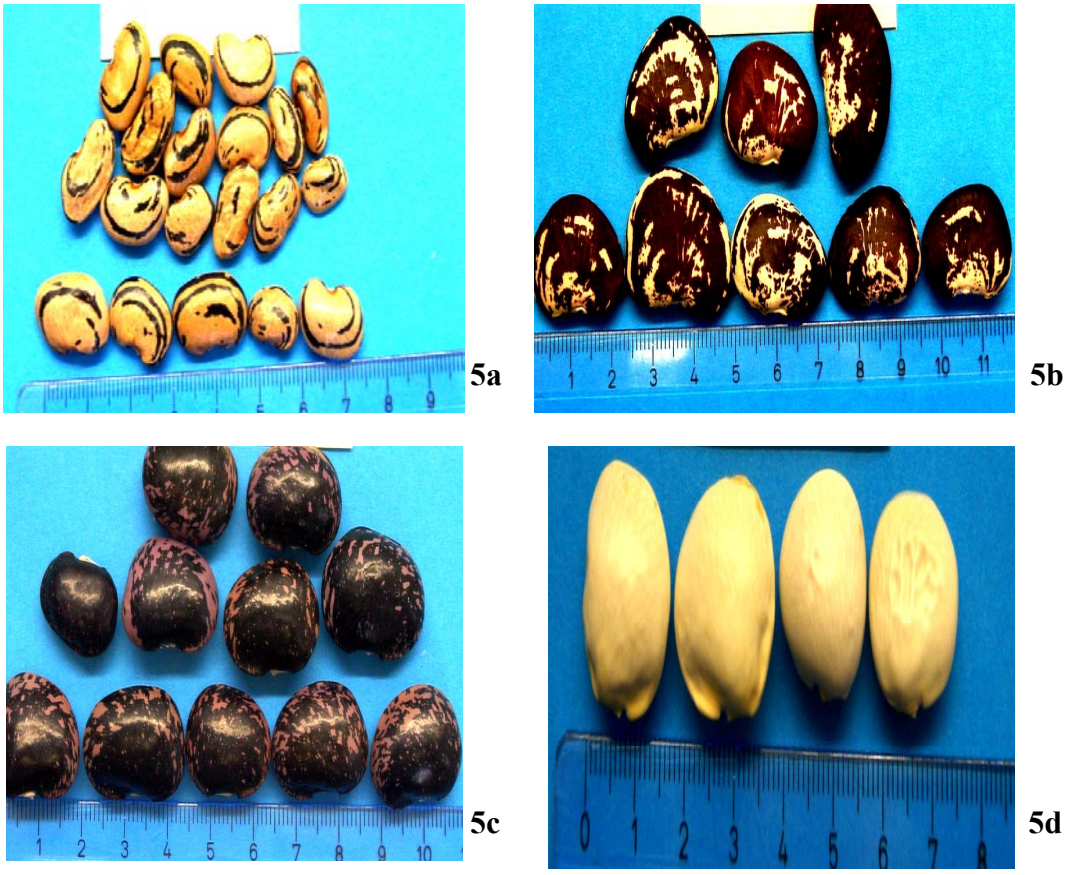

Figure 5: Some pulse seeds collected from the research area. 5a) *Phaseolus vulgaris,* 5b) *Ph. lunatus,* 5c) *Ph. coccineus* var. *coccineus,* 5d) *Ph. coccineus* var. *albiflorus*.

3132 Collection in sub-area 2

In this sub-area 12 accession of cereals, 10 accessions of pulses, 29 accessions of vegetables and 3 accessions of other species were collected. Changing climatic conditions and cold winters strongly reduced the percent of land used for tropical and sub-tropical fruit trees to just 3% (data from survey).

Several seed samples of spinach (*Spinacia oleracea* L.), with peculiar leaves and spiny seeds were collected from homegardens in Shir-kala site (Figure 6).

Figure 6: Spiny seeds of spinach which produce plants with peculiar leaves.

Spinach was cultivated over 2.000 years ago in Iran. Cultivation of spinach began during the Greek and Roman civilizations. The name of spinach is derived from the Persian word "ispanai" which means "green hand" which later became "spanachia" (Late Latin), to spinach (English). The Arabs named it 'the prince of vegetables'. Spinach was introduced and transported to Spain via Africa in 1100. The prickly seeded form was known in Germany in the 13th century and the smooth seeded form was not described until 1552. It is the smooth seeded form that is used today in most commercial production.

Homegardens in this area are suitable sites to domestication of wild plants. One example in this area is the cultivation of *Eryngium sp.* in homegardens. Two accessions from *Eryngium sp.* seeds were collected in this sub-area (Figure 7).

Figure 7: Seeds of *Eryngium sp.* collected from homegardens in Shir-kala.

Eryngium sp. locally named " Aweiyeh", and normally collected from the wild as a vegetable. It is used in the preparation of several local foods is occasionally cultivated

in the homegardens of Savadkouh for its young leaves, which are eaten as a vegetable (Figure 8).

Figure 8: *Eryngium sp.* A newly cultivated plant in the homegardens.

Beta vulgaris is cultivated in homegardens mainly for home consumption. The taproot and young leaves of *B. vulgaris* ssp. *vulgaris* L. are used in preparation of local foods. A decoction prepared from the seed is a folk remedy for tumours. Seed, boiled in water, is used to cure genital tumours. Gardeners normally leave a few numbers of plants to seed production. The seeds are produced in the second year at the end of a tall flowering stalk (Figure 9).

B. vulgaris ssp. *maritima* (L.) Arcang. occurs in the study area in field margins and is sometimes collected from wild and used as a cooked vegetable in local foods.

The centre of origin of sugar beet is believed to be the Middle East. It is thought that wild beets spread west into the Mediterranean and north along the Atlantic seacoast. The dispersal of wild types north into the mountains of Turkey, Iran, and the Caucasus Mountains of Russia, also led to the establishment of the species *B. trigyna* Waldst. & Kit., *B. lomatogona* Fisch. & Mey. and *B. macrorhiza* Stev. (Cooke and Scott, 1993). Wild beet spread east through most of Eastern Asia. Cultivated sugar beet is likely to have originated from wild beet (*B. vulgaris* ssp. *maritima*) through breeding selection (Cooke and Scott, 1993).

Figure 9: *Beta vulgaris* with tall flowering stalk.

Other vegetable seeds the farmers shared with us were onion (*Allium cepa* L.), leek (*Allium porrum* L.), coriander (*Coriandrum sativum* L.), cucumber (*Cucumis sativus* L.), gourd (*Cucurbita pepo* L.), and large gourd (*Cucurbita maxima* Duch.), and among the pulses, pea (*Pisum sativum* L.), and broad bean (*Vicia faba* L.*)*.

3133 Collecting sub-area 3

Altogether 14 accessions were collected in this sub-area. Among them an accession of the wild *Allium paradoxum* (M.B.) G. Don locally called "Alezi", Piyaz-zangvlehei, or Sirak-zangolehei (Mozaffarian 2000) was collected near the Folowrd.

This species was often observed as a wild vegetable in forest and mountains and was collected by villagers for use as a vegetable in preparation of some special local foods (Figure 10).

Although no specific mention of medicinal uses has been seen for this species, members of this genus are, in general, very healthy additions to the diet. They contain sulphur compounds, which give them their onion flavour. When consumed regularly they help to reduce blood cholesterol levels, act as a tonic for the digestive system and also tonify the circulatory system.

Figure 10: *Allium paradoxum*, locally called "Alezi". A newly cultivated plant in homegardens.

Another accession, which was collected in this area, is *Heracleum persicum* (Figure 11). This plant is an old magic plant in this area and normally seeds are collected from the wild plants and sold in local markets. The rural inhabitants make smoke by putting seeds in the fire and believe this protect them from the evil eye. Cultivation of this plant in some homegardens was observed. The seeds are also used as a spice in different foods and sours.

Figure 11: *Heracleum persicum* is a neglected crop in the Savadkouh area.

3134 Collection sub-area 4

In this sub-area 25 accessions were collected especially from cereals *Triticum aestivum* L. and *Hordeum vulgare* L. and from vegetables *Lepidium sativum* L. and *Cucumis sativus* L.

According to the diverse topography of this area homegardens are very small. Most of them contain only a few pome fruit trees and some seasonal vegetables.

Today only a few farmers remain on these sites and only some small fields and homegardens still exist. Collecting activity was therefore concentrated more on these sites (Figure 12).

Figure 12: The landscape of Paland.

314 Discussion

The collection showed that the study area is still an important refuge for landraces. These species are frequently forgotten from sustainable developmental programs in agriculture, although having a great potential to contribute to sustainable food production and to food security. The existing knowledge on the genetic potential of landraces is limited. The main reasons why these landraces are still more or less available, especially within homegardens and small fields, are traditional reasons which make them highly valued in rural populations or simply because they are appreciated by the families. Landraces have been adapted to the specific conditions through continuous selection over time and they often have relevant resistances and tolerances.

The problem of genetic erosion was observed in the research area, with the disappearance of the local landraces and many indigenous varieties replaced by new cultivars (especially in lowlands). In the highlands of the research area this phenomena was observed with decreasing agricultural activities in small fields and homegardens with relatively little plant diversity. There is a severe inclination for migration to cities because of uneconomic conditions of agricultural activities mainly in highlands. Major reasons are poor climatic conditions and a few flat lands available for agriculture in high lands. These factors have lead to faster erosion in landraces and minor crops.

The group of the so-called “minor crops”, “neglected crops”, and “underutilized crops” are species that have adapted to specific local conditions and play an important role in human nutrition (Hammer et al. 2001).

The weather extremes and climatic instability (Jackson et al. 1990), rarity and loss of resources quality (Yonezawa 1986), pollution (Frankel and Soulé 1981, Frankel et al. 1995), population growth (Hanson et al. 1995) and political unrest and wars (Fowler and Mooney 1990, Blom et al. 2000) are major reasons of genetic erosion in landraces.

Frankel (1970) pointed out that landraces are being lost at an alarming rate. One reason for this is the transition from traditional agriculture to intensive agriculture. Landraces as well as some cultivated species fall into disuse and are removed from the agricultural system. These processes have even resulted in some cultivated plant species being placed in red lists.

The loss of plant genetic resources on the level of varieties and species can only be visualized through the use of examples (See Hammer 1998, 2004, Hammer and Khoshbakht, in print a), since a comprehensive summary does not exist.

Respondents living in the research area were particularly interested in the use of medicinal plants. The use of medicinal, culinary and aromatic plants, herbs and spices in the region goes back thousands of years and forms an important part of culture. Although many of the species have fallen into disuse, traditional medicines still play a major role in health care systems. The introduction of a more extensive farming of medicinal plants should be considered to generate income. This requires more information about which species grow in the wild, their conservation status, how intensively wild species are harvested, how extensively they are cultivated and what are the existing and potential markets at local, national and international levels. This also requires the participation of the local community and its indigenous knowledge, and proper analysis of the socioeconomic, cultural, agricultural, technical, scientific and conservation factors involved.

315 Summary

An exploration mission was carried out jointly by Environmental Sciences Research Institute of Shahid Beheshti University in northern Iran / Savadkouh. Altogether 172 accessions together with ethnobotanical data were collected. There were 36 accessions from cereals, 43 from pulses, 80 from vegetables and 13 from other cultivated plants.

The selected accessions of collected seeds were sown later in greenhouse at the University of Kassel in Witzenhausen, Germany for later classification and preliminary evaluation.

The area still is rich in landraces and local varieties, but the problem of genetic erosion was observed in the research area.

32 Uses of neglected wild fruit trees and shrubs*

321 Introduction

Staple food crops produced for energy supply include rice (26%), wheat (23%), maize (7%), millet and sorghum (4%), potatoes (2%), sweet potatoes (2%) and other crops (18%) (Prescott-Allen and Prescott-Allen 1990). The other crops are of particular interest, as they collectively encompass the underutilized, neglected, traditional and indigenous plant species, that contribute significantly to the nutrition of rural communities. Neglected crops have been ignored by science and development but are still being used in those areas where they are well adapted and competitive (Hammer et al. 2001, Hammer 2004).

Information on uses of indigenous wild fruit trees of Iran is scarce and only occasionally mentioned in botanical works and inventories (Sabeti 1997). Although some studies about ethnobotany and especially about medicinal uses of plants have been published (e.g. Zargari 1976-1980, Amin 1991, Shokri and Safaian 1993, Emad 1999, Mirhidar 2001), there is no particular study on the use of fruit trees and shrubs in Savadkouh and the essential knowledge about them remains within the rural populations.

The present study was conducted to obtain a better understanding of the knowledge of rural populations about wild fruit tree and shrub species, to identify the potential of these species to improve nutrition, to generate new income, to conserve and protect the genetic resources and to contribute to sustainable use of these natural resources. The interactions between wild and cultivated plants in this area have received special interest.

322 Methodology

Fieldwork was conducted out in northern Iran in April / May 2004. Four sub-areas according to altitude including twenty villages and especially surrounding forests were visited (Figure 2, Table 2). Altogether seventy-five interviews were carried out. The interviews were one-on-one and respondents were carefully selected to represent both male and female but they had to be forty or more years of age. Experience has shown that older people have more traditional knowledge than younger people do. The interviews were carried out mainly in afternoons when the local people were either resting at home or at the shopping centres. In addition to the data recorded directly by interviews, further information was registered from informal market surveys, local specialists and rural experts.

* This part of the study was accepted as an article in Genetic Resources and Crop Evolution journal (Khoshbakht and Hammer, accepted).

323 Results

Eleven fruit tree and shrub genera were identified in the north of Iran, which people use as a part of their diet regime. A list of them, their plant parts and the uses are given in Table 4. Species are arranged in alphabetical order. Indigenous knowledge reported here was obtained from the responses in the visited zones as well as from the literature.

3231 *Berberis sp.* (Berberidaceae)

The common barberry is a thorny deciduous shrub with yellow wood growing up to 3 m in height. It has arched and hanging branches, with clusters of alternate pale green, stiff and toothed leaves. The small yellow flowers, which have an unpleasant smell, occur in elegant drooping racemes. These later give way to small red oblong berries (Figure 13). The fruits are used in preparation of marmalade, juice, sour and a special tart candy that is locally named 'Lavashak' and also as a condiment and food additive in several folk foods. Almost all parts of common barberry are used as a medicine in traditional cures (Table 4).

Although the province of Khorasan, located in the northeastern Iran, is the production center for *Berberis vulgaris* L. (with about 6.000 hectares of field growing — Tehranifar 2003), the barberry fruits in northern Iran are collected from the wild. *B. integerrima* Bunge, *B. crataegina* DC., *B. orthobotrys* Bienert ex C.K. Schneider, and hybrids of *B. integerrima* × *vulgaris* , *integerrima* × *crataegina*, *integerrima* × *orthobotrys and calliobotrys* × *integerrima* and *B.* × *lamondiae* were reported from the north of Iran (Browicz and Zielński 1975). They are all collected and used by local people.

Table 4: Wild fruit trees, local names, part of plant and uses in north of Iran.

Taxon	Local names	Part of plant and uses
Berberis sp.	Zereshk, Mialesk, Malesk	Fruits are edible and used for sour, marmalade, tart candy, treatment of diarrhoea, biliary disorders, heartburn, reduce fever, improve appetite, relieve upset stomach, promote vigour, and as a relish. Bark of stem and root as a tonic and purgative. Wood used in handicrafts and colouring of wool. Root for colouring of wool and cotton and silk. Root and leaf extracts for strengthening gums.
Crataegus sp.	Zalzalak, Valeik, Mamili, Marekh, Valak, Balak	Fruits are edible and used in treatment of diarrhoea. Flowers are brewed and used to

		remedy of cardiac weakness, blood pressure, sleeplessness, anxiety, agitation and vertigo. Wood for handle of hatchet and other agriculture tools Bark of stem used to reduce fever.
Cydonia oblonga	Beh, Shalbeh, Shoghal beh Beh jangali	Fruits are edible and used to prepare marmalade, sauce and remedy of diarrhoea. Leaves used in folk medicine to treat of sleeplessness.
Diospyros lotus	Khormandi, Khervendi, Kalhu, Kahlu, Arb, Arba, Arbehdar	Fruits are sedative and used in folk food and medicine as a treatment for constipation. Wood used in construction and general carpentry. Leaves used to reduce fever.
Ficus carica	Anjeir, Anjil, Shalanjir, Divanjir, Enji, Kashkal	Fruits are edible and used to prepare, marmalade, sauce, and used as poultices on tumours and other abnormal growths. A decoction of the fruits is gargled to relieve sore throat. Figs boiled in milk are repetitively packed against swollen gums. Crushed leaves used to treat and leaf juice used in treatment of skin diseases. Latex is purgative and used to tenderise meat and also is applied on warts, skin ulcers and sores.
Malus orientalis	Sieb, Se, Siv, Torsh hasi, Talkh hasi	Fruits are edible and mostly used when they are unripe.
Mespilus germanica	Azgil, Konos, kenes	Fruits are edible and are used to prepare jelly, juice, sour and local foods. Fruits are useful in remedy of children diarrhoea. A decoction of leaves is gargled as mouth cleaner.
Prunus cerasifera ssp. *macrocarpa*	Alocheh, Shalhalu	Fruits are edible and dried fruits are used in several local foods as a relish.

Prunus spinosa	Halaleh	Fruits are edible and dried fruits are used in several local foods as a relish. Fruit, flower, bark of stem are used to remedy of constipation. Bark of root and stem are used to reduce fever. A decoction of fruits is gargled to treat throat sores and gingivitis.
Punica granatum	Anar, Nar	Fruits are edible and used to prepare juice, sauce and sour candy. A decoction of flowers used to treat diarrhoea and gargle of this used to remedy of tonsil pains. A decoction from bark of root or stem used against of parasite diseases. A decoction of leaf used in treatment of weak activity of stomach, weak appetite, anemia and migraine.
Rubus sp.	Tameshg, Lam,Tamushi, Valash,Valush, Balush,Tamish	Fruits are edible and used to prepare marmalade, juice and ripe fruits are used in cosmetic. Flower, leaf, root used in folk medicine as tonic and blood cleaner.

Figure 13: Barberry shrub and dry fruits.

B. integerrima is also cultivated in Iran (especially in Khorasan) for the berries. The cultivated races have rather large fruits. Also seedless varieties occur. The berries are preferably consumed raw but are also conserved by drying. From the bark a brown dye is obtained. *B. integerrima* easily crosses with other species also with *B. vulgaris* and shows a very large variation, which has lead to the description of several species (Browicz and Zieliński 1975).

3232 *Crataegus sp.* (Rosaceae)

Hawthorn is a large group of hardy, deciduous trees or shrubs and most of them are natives of North America, Europe, Asia Minor, China, Japan, the Old World and the Himalayas (Figure 14). The fruits vary widely from species to species, though the basic structure is always the same: externally it is somewhat like a small apple, the thin skin covering a fleshy pulp. The colour of the ripe fruit ranges from yellow to red and purple to black.

Twenty-two species and five hybrids have been reported from Iran including *C. pentagyna* Waldst. & Kit. ex Wild., *C. pseudomelanocarpa* M. Pop. ex Pojark. , *C. meyeri* Pojark., *C. songarica* Koch, *C. turkestanica* Pojark., *C. pseudoheterophylla* Pojark., *C. microphylla* Koch, *C. × armena* Pojark. and *C. pentagyna × C. songarica* which grow in northern Iran mainly as wild plants (Khatamsaz 1992) and sometimes cultivated in hedges. Rural people divide them into two groups depending on fruit colour, namely "Sorkh valik" (with red fruit) and "Seiyah valik" (with black fruit). Fruits are edible and villagers believe that they have a tonic effect on the heart and they are used in the treatment of weak heart conditions, especially if this is

accompanied by high blood pressure. The hawthorn species are suitable as forst-resistant rootstocks for pome fruits like pear and quinces.

Figure 14: Hawthorn shrubs in near Folowrd (northern Iran).

3233 *Cydonia oblonga* Mill. (Rosaceae)

The quince, *Cydonia oblonga*, is the only member of the genus and grows as a wild plant in the Caucasus, northern Iran and Kopet Dagh range (Zohary and Hopf 1988). The primary wild area was probably limited to the eastern Caucasus and Transcaucasus from Daghestan to Talysh. Partially connected with this core area are populations in Anatolia, Syria, Turkmenia and Afghanistan, however perhaps only as relics of the early spread of cultivated forms. True wild trees in the center of origin in the Caucasus have a small crown and small fruits (3 cm across) (Büttner 2001). The quince plants that are distributed as wild fruit trees in northern forests of Iran (Sabeti 1997, Zohary and Hopf 2000) as well as cultivated trees in gardens, which are deciduous and thornless trees (rarely shrubs) up to 8 m high and 3-4.5 m wide. The young branchlets are covered with pale greyish wool. Leaves are elliptical, with entire margins, often larger than those of apple or pear. Flowers are pink or white, solitary at the end of short twigs, produced in May, after the leaves. Fruits are generally bright yellow and usually pear shaped. The cultivation of quince began from Caucasus regions about 4000 years ago (according to our observations also the wild races from the Hyrcanian area should be considered here), later on there are reports about quinces in Greece (600 BC) and Rome (200 BC) and today it is cultivated in all countries with warm-temperate to temperate climates.

Most of people prefer to eat quinces after cooking as marmalade. The word "marmalade" comes from the Portuguese "marmelo" meaning quince. In fact, until the end of the 18th century, marmalade was made almost exclusively of quinces. Fruits of wild plants in the study area are used for the preparation of marmalade as well as in folk medicine to treat constipation.

3234 *Diospyros lotus* L. (Ebenaceae)

The date-plum or Caucasian persimmon, *D. lotus*, is a wild deciduous tree in northern Iran (Sabeti 1997), which grows up to 20 m high (Figure 15). Leaves are alternate, elliptic to ovate-oblong, 5-18 cm long, and 3-7 cm wide with margin entire, apex acute to acuminate: the lamina is dark green and glabrous above, paler with scattered hairs beneath. Small greenish flowers, not very showy, with a large calyx (Rechinger 1966). *D. lotus* is mostly used in the area as grafting stock for *D. kaki* Thunb. and can be grown also at higher elevations. Fruits are 1-2 cm across, yellowish and becoming bluish-black when completely ripe. The fruits are not eaten in immature form because of their astringent taste. Mature fruits or dried ones that are collected from the forest are eaten and used in folk medicine as a treatment for constipation. For more information see Table 4.

Figure 15: *Diospyros lotus*, locally named Khormandy, used as a grafting stock for *D. kaki*.

3235 *Ficus carica* L. (Moraceae)

The fig, *Ficus carica* is native to western Asia. Probably domesticated in the eastern part of the Mediterranean area (Ohle 1986). It seems to have been part of the food production in this area since at least the Early Bronze Age, providing fresh fruit in summer and storable, sugar-rich, dry figs all the year round (Zohary and Hopf 1988). The deciduous leaves are palmate, deeply divided into 3 to 7 main lobes, these again

more shallowly lobed and irregularly toothed on the margins. The blade is 5-35 cm in length and width, fairly thick, rough on the upper surface, softly hairy on the underside. The synconium, a fleshy, hollow receptacle with a small opening at the apex, is partly closed by small scales. Fruits are 2-3 cm across in the wild (Azizian 2001) and up to 8 cm in diameter in cultivated forms (Browicz 1982).

The cultivated fig tree shows a close morphological resemblance, striking similarities in climatic requirements, and tight genetic interconnections with an aggregate of wild and weedy forms, which are widely distributed over the Mediterranean basin. Botanists regard them as the wild progenitor of the cultivated fruit tree and place them within *F. carica* L. (Zohary 1973, Browicz 1986, Tutin 1993). This wild-feral-cultivated fig is closely related to a group of non-Mediterranean wild, deciduous *Ficus* types distributed south and east of the Mediterranean region (Zohary 1973, Browiz 1986).

Tall, large fig trees grow in the lower zone of the mesic, deciduous forests of the Colchic (Black Sea) district of northern Turkey and the Hyrcanic (south of Caspian Sea) district of Iran and adjacent Caucasica (Zohary and Spiegel-Roy 1975, Zohary and Hopf 1988, 2000). These forest types intergraded with the typical Mediterranean *F. carica*. Most authors include these wild forms into *F. carica*. They deserve recognition and have been accepted by Russian botanists (see Zhukovsky 1964) as *F. colchica* Grossh. and *F. hyrcana* Grossh. They are planted in the gardens as grafting stock for *F. carica.* Other members of the series *Carica* are warm climate, xeric shrubby types distributed outside the traditional area of fig cultivation: *F. johannis* Boiss. in the Zagros Mountains and southern Iran; *F. virgata* Roxb. in Afghanistan (Zohary and Hopf 1988); *F. pseudosycomorus* Decne in south Jordan, the Negev, Sinai, and Egypt, and *F. palmata* Forssk. in Yemen, Somalia and Ethiopia (Zohary and Hopf 2000).

Wild populations of *Ficus carica* with very tall trees and small fruits were observed specially in the forests of zones 1 and 2. Today cultivation of *F. carica* is very common in homegardens of Savadkouh (Figure 16). Fruits are edible and used to prepare marmalade and sauce and most parts of the plant are used as folk medicine to treat diseases (Table 4). Fully ripe fruits are dried in the sun and eaten as dried fruits (Figure 17).

Figure 16: Wild *Ficus carica* with small fruit and tall trees cultivated in homegardens.

Figure 17: Dry fruits of *Ficus* collected from big wild trees in the natural forests (*F. hyrcana* Grossh.) are sold in local markets. Bar = 1 cm.

3236 *Malus orientalis* Ugl. (Rosaceae)

Malus orientalis (syn. *M. pumila* Grossh. non Mill.) is distributed in the Caucasus, the north of Anatolia, Armenia, the mountain belt in the northern part of Iran (Büttner 2001) as well as in the west, east and central Iran (Sabeti 1997, Browicz et al. 1969). According to this rather wide distribution there is a high variability of vegetative and fruit characters. Therefore, *M. orientalis* could also have contributed to the domestication of the apple (*M. domestica* Borkh.) by some character introgression (Büttner 2001).

The fruits are small (2-3.5 cm across), sour/sweet, more or less astringent and bitter. Seedlings are used as well-adapted rootstocks for *M. domestica* Borkh. and cultivation of *M. orientalis* for self-consumption in few homegardens was observed (Figure 18).

Figure 18: *Malus orientalis* with small red fruits cultivated in homegardens.

3237 *Mespilus germanica L.* (Rosaceae)

The medlar, *Mespilus germanica* L. is a wild deciduous thorny shrub, growing up to 2-3 m high in this area (Khatamsaz 1992). First plantations were about 1.000 BC on the Caspian coast, and then cultivation proceeded through Asia Minor to Greece and Italy (about 200 BC). In the Middle Ages it was widespread in Central and West Europe, later on almost disappearing with since that time occurring only single trees naturalized as relics of former cultivation (Büttner 2001). In the study area, especially

in deforested parts, semi-cultivated plants have been observed, remaining from the original populations.

The fruit is a pome, and has variable shapes, from conical-elongated, to spherical or flat. The skin colour is brown, sometimes tinged reddish. The brown-reddish flesh is hard and austere at ripening time but it becomes soft and edible when the over-ripening process occurs as a result of time and frost.

One of the common uses of medlar fruits that are collected from the forest is the raw consumption after over-ripening. These fruits have a sweet and slightly acid flesh and are used in the preparation of medlar conserve, jams, sour, jellies, and a sap that locally named "Dooshab". The villagers prepare syrup by boiling semi-ripe fruits with sugar and use it in treatment of children's diarrhoea. A gargle of leaf extract is used as a remedy for a swollen throat.

3238 *Prunus cerasifera* Ehrh. ssp. *macrocarpa* Erëmin & Garkov (*P. iranica* Koval., *P. cerasifera* ssp. *nachitschevanica* Koval., *P. cerasifera* ssp. *pontica* Koval.) (Rosaceae)

The wild mirobalan, *P. cerasifera* Ehrh. subsp. *macrocarpa* Erëmin & Garkov (*P. divaricata* Ledeb.) is a deciduous thorn less tree or shrub up to 10 m in height and is native in Caucasus, Asia Minor, Balkan Peninsula to Central Europe. The trees are apparently all self-incompatible, reproduce from seed and bear roundish, small (2 cm in diameter) yellow, red or dark red fruits, which taste very much like the cultivated plums (*P. domestica* L.). *P. divaricata* wild forms fall into several eco-geographic races (Browicz et al. 1969, Khatamsaz 1992), among them *P. cerasifera* ssp. *macrocarpa* which occurs in the Caspian coast of Caucasus and Iran. Louneva (1999) has given hybrid status to several taxa (e.g. *P.* × *nachitschevanica* Louneva = *P. cerasifera* × *P. salicina* Lindl. , *P.* × *taurica* Luneva).

Wild mirobalan is in flower from April to May and insect pollinated hermaphrodite flowers appear before the leaves. It is used as a rootstock for grafting *P. domestica* cultivars. Fruits are mainly collected from the forest. They are edible and used in several local foods. Cultivation of this plant was also observed in some homegardens. All members of the genus contain amygdalin and prunasin, substances that break down in water to form hydrocyanic acid (cyanide or prussic acid). In small amounts this exceedingly poisonous compound stimulates respiration, improves digestion and gives a sense of well-being. For more information about uses see Table 4.

3239 *Prunus spinosa* L. (Rosaceae)

Cultivated hexaploid *P. domestica* is thought to be a polyploid product of a cross between *P. cerasifera* and *P. spinosa*. The *P. domestica* plums look strikingly similar to the *P. divaricata* forms. Both groups intergrade and apparently intercross with one other. In contrast, *P. spinosa*, with its small and very astringent fruits, is morphologically distinct and seems to be isolated reproductively from the *domestica-divaricata* plums. We know very little about the beginning of plum domestication, but since its culture depends on grafting, this fruit tree was probably taken into cultivation

together with apples and pears. The earliest records of plum planting and grafting are from Roman times.

The blackthorn, *P. spinosa* is a deciduous spiny shrub with beautiful white blossoms which appear early in spring. The wild distribution of this species is through Europe to the Urals, north of Africa, north of Anatolia, Caucasus, north of Iran and northwest of Turkmenistan. As a thorny shrub it is planted for soil stabilisation, also as a hedgerow for wind protection. Cultivation for the fruits seems to be known more recently only in different regions of Russia (Büttner 2001) and even in this area mainly they are wild fruit trees. Fruits are black or bluish-black in colour and the flesh is green. The bitter fruits are known as sloes, and are used to make jellies, conserves and syrups and they have also been put to various uses in folk medicine. The flowers are used as a blood cleaner and the leaves have been dried and used as a substitute for tea. Furthermore, dyes have been obtained from the fruits, leaves and bark.

32310 *Punica granatum* L. (Punicaceae)

The pomegranate, *Punica granatum* belongs to Vavilov's Centre of Origin IV, Central Middle East that includes the interior of Asia Minor, the Caucasus, Iran and the highlands of Turkmenistan. It is a deciduous shrub or tree with conspicuous red flowers and large fruits (6-12 cm across) characterized by a leathery rind, persistent crown-like calyx, and numerous seeds covered with a juicy flesh. The wild forms of *P. granatum* grow in masses in the south Caspian belt (Figure 19), in northeastern Turkey, and in Albania and Montenegro (Zohary and Hopf 1988, 2000). Wild populations of pomegranate with small, sour and dehiscent fruits have been observed within homegardens and forests.

Figure 19: Wild population of pomegranate shrubs.

The fruits can be eaten fresh, or can be used for preparation of juice, sauce or in several local foods as a condiment. Lavashak (Figure 20) is a local tart candy, which

traditionally was prepared by heating the fruits for a long time, but today because of more demand, small factories for preparation of this have been established.

All parts of the tree are used in folk medicine for different treatments (see Table 4) and the skin of the fruit is used in the tanning industry.

Figure 20: “Lavashak” special tarts candy.

32311 *Rubus sp.* (Rosaceae)

Rubus species are climbing wild perennial woody shrubs or in rare cases herbaceous (like *R. saxatilis*). Flowers are red, purple or white with 5 sepals and stamens many to more than 100, inserted with the five petals at the edge of hypanthium. The fruit is an aggregation of weakly coherent drupelets, often remaining attached to the fleshy receptacle. Stems are often strongly armed with prickles or bristles, leaves are with alternate simple to ternate or pinnate. The colour of the ripe fruits in some species like *R. saxatilis* are red and in some of them like *R. hirtus* and *R. hyrcanus* are black (Figure 21). The ripe berries are typically picked and eaten raw. The berries are also cooked in sauces, juice and marmalade. Fruits and leaves as well as roots are used in folk medicine (Table 4).

The general term for Rubus species in Iran is “Tameshg” and from this genus *R. caesius* L., *R. hirtus* Waldst. & Kit., *R. armeniacus* Focke, *R. sanctus* Schreber, *R. persicus* Boiss., *R. hyrcanus* Juz., *R. dolichocarpus* Juz., *R. karakalensis* Freyn, *R. astarae* Gilli, *R. esfandiarii* Gilli and *R. lahidjanensis* Rech.f. are distributed in northern Iran (Khatamsaz 1992) and people collect fruits of them mainly from the natural wild forests. The *Rubus* contains a large number of highly variably and heterogeneous species, which occur in all parts of world except the desert regions (Jennings et al. 1990). Wild and semi-cultivated forms are found in research area. They serve as fruit shrubs as well as natural fences for homegardens to separate them from surrounding fields.

R. sanctus is cultivated in southern Kazakhstan for its fruits and is also used for blackberry breeding. Its wild distribution includes Europe (Balkan Peninsula, Istria), the eastern Mediterranean region (Turkey, Israel, Syria etc), Iran, Crimea and the Caucasian region.

R. caesius is cultivated for its fruits only locally in the Caucasian area (Kuban). Young leaves are used as a substitute for tea. The natural distribution of this species is Europe, except for the southern Mediterranean area, and the north beyond 62° of latitude, west Asia to Iran and, partly disjunct, to the Altai.

Occasionally, *R. anatolicus* (Focke) Focke ex Hausskn. (Sensu Flora Iranica Vol. 66, p.72, Browicz et al. 1969) is found in a kind of semi-cultivation in the area investigated. All other species of this taxonomically difficult genus are used from wild shrubs.

Figure 21: Rubus shrubs and fruits.

324 Discussion

Wild fruit trees have an important role in supplementing other foods as well as in enhancing the quality of the environment, and nutrients can be obtained easily from the consumption of these fruits. Our results indicate that the fruits are usually collected freely from the natural forests. There is a need, however, to encourage their cultivation in homegardens or on farms alongside other crops. In this way harvesting can be done to supply the growers' needs and the surplus sold to improve the household economy.

Domestication efforts were recognized for plants by both protecting and managing naturally grown species or by planting individual trees in homegardens and small fields. *Diospyros lotus*, *Ficus carica*, *Malus orientalis*, *Mespilus germanica*, *Prunus cerasifera* ssp. *macrocarpa* and *Prunus spinosa* are occurring as single plants in homegardens and small fields. Gene flow between farmers can be helping them to broader distribution. *Punica granatum*, *Berberis*, *Crataegus*, and *Rubus* species are serving also as fence for homegardens. They are occurring in widespread and are common in alongside of roads, open scrub, rocky slops, riverbanks, fixed dunes, coastal plains and waste places in research area.

Collecting information about how people deal with their natural surroundings is not only important for the recording of local cultural traditions and the richness of this heritage, but also gives us some of the information necessary to protect our natural

habitat in the long term. If we consider that the number of Iran endemics is about 1400 (Davis et al.1997) we can see the urgency of this kind of ethnobothanicl research. There may not be other chances to record how these species are used (or were used). We must remember not only that plants are endemic, but also that local knowledge is equally endemic and now may have a much shorter life span than many of the plants. Among the plants described *Rubus grantii*, *R. astarae*, *R. esfandiarii* and *R. lahidjanensis* are endemic and in addition there are many other local types of trees and shrubs. Whereas the Caucasian area (Vavilov and his school) and Turkey (e.g. Ercisli 2004, Ertuğ 2000, 2004) have been considered as important areas for fruit tree evolution, the Hyrcanian area of Iran has only obtained limited consideration. Evolutionary relations between wild and cultivated fruit trees and shrubs in the area have been observed and are in need of further studies.

The results of this investigation show a dependence on trees and shrub species as sources of local foods and medicines. Fruits of all these species are used as table fruit and in preparation of marmalade, candy as well as local foods. A special consideration is observed to use of these plants to remedy illnesses in folk medicine. There is a need to appreciate the importance of these species and encourage further research.

325 Summary

Fieldwork was carried out in the north of Iran in April / May 2004. Four zones according to altitude including twenty villages and especially surrounding forests were visited. Data on uses and ethnobotany was collected through interviews that were one-on-one with respondents carefully selected to represent both male and female. Additionally a general survey of the area including other places of Savadkouh has been performed. The fruit trees and shrubs include *Berberis sp*., *Crataegus sp.*, *Cydonia oblonga*, *Diospyros lotus*, *Ficus carica*, *Malus orientalis*, *Mespilus germanica*, *Prunus cerasifera* ssp. *macrocarpa*, *Prunus spinosa*, *Punica granatum*, and *Rubus sp.* Most of these are gathered from the wild, or occasionally cultivated in homegardens. The results of this study show that all of these species are used as sources of local foods and medicines. The area is an important evolutionary center for fruit trees and shrubs and should be taken into serious consideration for discussions about fruit tree and shrub evolution. Germplasm collection activities, *in situ* conservation programs and interdisciplinary analysis of socioeconomic aspects of rural communications will be necessary in future studies.

33 Interdisciplinary analyses of homegardens: plant uses and socioeconomic aspects*

331 Introduction

Homegardens represent microenvironments within larger systems involving deliberated management of multipurpose trees, shrubs, annual and perennial agriculture crops, herbs, spices, medicinal plants and animals on the same land unit in either a spatial arrangement or a temporal sequence (Michon et al. 1986, Okafor and Fernandes 1987, Padoch and de Jong 1991). These gardens are important sources of food, fodder, fuel, medicines, spices, construction materials, and income in many countries around the world. They also maintain crop and agroforestry genetic resources, which may not be found in more extensive agroecosystems. The major functions of homegardens, especially in rural areas are subsistence production and income generation (Soemarwoto and Conway 1992). Because of the high diversity in homegardens, a wide range of products can be produced with relatively low inputs (Christantly 1990, Hochegger 1998, Soemarwoto and Conway 1992).

Among other system productions, homegardens can protect soil from erosion, offer a habitat to wild plants and make efficient use of light, water and other resources (Christanty et al. 1986, Karyono 1990, Torquebiau 1992, Jose and Shanmugaratnam 1993). They are also an ideal system for evolution and *in situ* conservation of genetic resources (Esquivel and Hammer 1988, 1992b, Hammer 2002, 2004). Diversity in homegardens, is influenced by ecological factors of gardens and the socioeconomic characteristics of gardeners (Christantly et al. 1986), the altitude of homegardens (Karyono 1990, Quiroz et al. 2002), homegarden size (Abdoellah et al. 2001), the age of homegardens (Quiroz et al. 2002) and level of production intensity and market access (Michon and Mary 1994).

The homegardens have attracted considerable research attention in different aspects (Esquivel and Hammer 1992a, Wojtkowski 1993, Hodgkin 2002, Trinh et al. 2002, Kehlenbeck and Maass 2004). These microenvironments are dynamic systems and their structure, composition, species and cultivars diversity are influenced by changes in the socioeconomic circumstances and cultural values of the households that maintain these gardens.

Interdisciplinary studies with concerning both the socioeconomic and agroecologic aspects of homegardens are necessary for a better understanding their function and benefits. This fact has been considered in many of homegarden literature (Budowski 1990, Landauer and Brazil 1990, Nair 1993, Lok 1998, Méndez et al. 2001).

This study was conducted to inspect the relationship between socioeconomic aspects, biodiversity and plant uses of the homegardens in Savadkouh. To date, little information is available on homegardens outside tropical and subtropical areas. This is the first specific study of homegardens in humid parts of Iran.

* This part of the study was submitted as an article to the journal Agroforestry Systems (Khoshbakht et al. submitted).

332 Methodology

Fieldwork was carried out in northern Iran in April/May 2004. Four sub-areas according to different altitudes including twenty villages were visited (Figure 2 and Table 2). Altogether eighty homegardens (four in each village) were randomly visited and complete information on socioeconomic factors, plant species diversity (except ornamental plants) and their uses was collected through direct observation of the homegardens and interviews with farmers. The interviews were one-on-one and respondents carefully selected to represent both male and female (47 %). Most of the plants had multiple uses but classification was done based on main use as suggested by farmers. Classification of the homegardens was done according to the farmer's perception as gathered from quantitative data. Data analyses showed different types of homegardens (e.g., vegetable, fruit and mixed homegardens). Cluster analyses were run utilizing both socioeconomic and agroecologic variables, but maintaining the number of groups from the *a priori* field classification in order to contrast farmer's perceptions, based on the function of their homegardens, with statistical classifications. This was done using Ward's minimum variance method to identify homegarden types, with squared Euclidean distances used as a measure of dissimilarity. In this study, the most compatible statistical classification, which matched field-based functional classification in 81.3% of the cases, was used. This was obtained using the following variables, which were standardized to zero mean and variance one: 1) total area 2) total number of zones 3) total number of uses 4) total number of species 5) fruit trees area 6) vegetables area 7) pulses area 8) and percentage of total income from homegarden. The contribution of these variables to the formation of clusters was ascertained through a stepwise, variable discriminant analysis. Between groups, comparisons for each variable were evaluated with a one-way analysis of variance.

333 Results

3331 Plant uses

Altogether seventy-eight plant species with four different main uses were identified. Although most species had multiple uses, the main use as reported by the farmer was used for the classification. A list including scientific, common and local names is presented in Table 5.

Plant species diversity per homegarden ranged between 5-29 species, with an average of 18 species, between 3-17 species, with an average of 9 species, between 2-16 species, with an average 9 species and between 3-12 species with average 7 species in first to forth sub-areas respectively. In first sub-area Citrus fruit trees like *Citrus sinensis* (L.) Osbeck and *Citrus limon* (L.) Burm. f. were found in 90 % the of homegardens and this percent was reduced to 35% in sub-area 2. Citrus trees were rare plants in the other sub-areas. With increasing altitude, in sub-area 2 and 3, Citrus fruit trees substitute with another fruit trees like *Prunus* × *domestica* L. and *Malus domestica* Borkh. Vegetables belonged to the most frequent species in all sub-areas and among them *Phaseolus vulgaris* L., *Allium sativum* L. and *Cucurbita pepo* L. They were used as both fresh and dried vegetables in several local foods. Plant diversity in different sub-areas was highest for fruits with 29 species in sub-area 1,

followed by vegetables with 26 species in sub-area 1, pulses with 8 species in sub-areas 1, 2, 3 and finally other crops with 6 species in sub-areas 1, 3 (Table 6).

Table 5: plant species in homegardens.

Plant use categories and species	Common name	Local name
Vegetables		
Allium cepa L.	Onion	Peiyaz
Allium paradoxum (M. B.) G. Don	-----	Alezi
Allium porrum L.	Leek	Tareefarangi,Gandna
Allium sativum L.	Garlic	Seir
Allium sp.	------	Taree
Anethum graveolens L.	Dill	Shveid, Shbet
Apium graevolens L.	Celery	Karafs
Beta vulgaris L.	Sugar beet	Choghondar ghand
Brassica rapa L.	Turnip	Shalgham
Capsicum annuum L.	Pepper	Felfel sabz
Coriandrum sativum L.	Coriander	Geshneiz
Cucumis sativus L.	Cucumber	Kheiyar
Cucurbita maxima Duch.	Gourd	Kado-e tambal
Cucurbita pepo L.	Summer squash	Kado-e mosamaey
Daucus carota L.	Carrot	Haveych
Eryngium sp.	-----	Awiyeh
Foeniculum vulgare Miller	Fennel	Razieyaneh
Lactuca sativa L.	Lettuce	Kaho
Lepidium sativum L.	Cress	Tartizak, Ozmak, Shahi
Lycopersicon esculentum Mill.	Tomato	Gojeh farangey
Mentha aquatica L.	Water mint	Sosanbar, Poneh-e abei
Mentha longifolia (L.) Hudson	Horse mint	Podeneh-e ykrang
Mentha × piperita L.	Pepper mint	Nanaa
Ocimum basilicum L.	Sweet basil	Ryhan, Tokhm sharbaty
Petroselinum crispum (Miller) Nym. ex A.W. Hill	Parsley	Gafary
Raphanus sativus L.	Radish	Torob, Torobcheh
Solanum melongena L.	Eggplant	Bademjan, Badenjan
Solanum tuberosum L.	Potato	Seib zaminei
Spinacia oleracea L.	Spinach	Esfenaj
Fruit trees		
Actinidia chinensis Planch.	Kiwi	Kiwi
Armeniaca vulgaris Lam.	Apricot	Zardalo
Beberis sp.	Barberry	Zereshk, Mialesk, Malesk
Cerasus mahaleb (L.) Miller	Mahaleb cherry	Mahlab
Cerasus vulgaris Miller	Sour cherry	Albalo
Citrus aurantifolia (Christm. & Panz) Swingle	Lime	Limo torsh, Limo amani
Citrus aurantium L.	Sour orange	Naranj
Citrus limon (L.) Burm. f.	Lemon	Limo shirin
Citrus reticulata Blanco	Tangerine orange	Narangy

Citrus sinensis (L.) Osbeck	Orange	Portghal
Corylus avellana L.	Filbert	Fandogh
Crataegus sp.	Hawthorn	Zalzalak, Valeyk, Mamili
Cydonia oblonga Miller	Quince	Beh, Beh jangali
Diospyros kaki L.	Persimmon	Khormalo
Diospyros lotus L.	Date-plum	Khormandy
Eriobotrya japonica (Thunb.) J. Lindl.	Japanese loquat	Azgeil zhapony
Ficus carica L.	Fig	Anjeir
Fragaria vesca L.	Strawberry	Tout farangi
Juglans regia L.	Walnut	Gerdo
Malus domestica Borkh.	Apple	Seib
Malus orientalis Ugl.	Oriental apple	Seib jangaley
Mespilus germanica L.	Meldar	Azgeil, Konos, kenes
Morus alba L.	White mulberry	Tout safeid
Morus nigra L.	Black mulberry	Tout seiyah
Olea europaea L.	Common olive	Zeitoun
Persica vulgaris Miller	Peach	Holo
Prunus avium L.	Cherry	Gilas
Prunus cerasifera Ehrh. ssp. *macrocarpa* Erëmin & Garkov	Wild myrobalan	Alocheh, Shalhalu
Prunus × *domestica* L.	Plum	Alo
Punica granatum L.	Pomegranate	Anar, Nar
Pyrus communis L.	Pear	Golaby
Rubus sp.	Blackberry	Tamesh
Vitis vinifera L.	Grape	Angour

Pulses

Cicer arietinum L.	Chicken pea	Nokhod
Lens culinaris Medicus	Lentil	Adas, Marjy
Phaseolus coccineus L. var. *albiflorus* (DC.) Bailey	Scarlet runner bean	Lobiya
Phaseolus coccineus L. var. *coccineus*	Bean	Lobiya
Phaseolus lunatus L.	Bean	Lobiya
Phaseolus vulgaris L.	Bean	Lobiya
Pisum sativum L.	Pea	Nokhod sabz
Vicia faba L.	Broad bean	Baghela
Vigna unguiculata (L.) Walp.	Catjang	Lobiya chashmbolboli

Others

Brassica napus L.	Colza	Colza
Helianthus annuus L.	Sunflower	Gol-e aftabgardan
Heracleum persicum Desf. ex Fischer	Persian cow-parsnip	Golpar
Salix aegyptica L.	Egyptian willow	Bidmeshk
Sesamum indicum L.	Gingelly	Konjed
Trifolium repens L.	White clover	Shabdar safeid
Trigonella foenum-graecum L.	Fenugreek	Shanbalileh

Table 6: Plant uses, total number of species and frequency in homegardens.

Plant uses	Total number of species				Frequency in homegardens			
	Sub-area 1	Sub-area 2	Sub-area 3	Sub-area 4	Sub-area 1	Sub-area 2	Sub-area 3	Sub-area 4
Vegetables	26	24	25	18	16	13	14	19
Fruits	29	25	14	12	17	18	18	13
Pulses	8	8	8	5	18	14	4	11
Others	6	4	6	3	12	7	10	8

3332 Size and zones in homegardens

Six different management zones were identified (Table 7). The average homegarden's area in the different sub-areas was very diverse, rising from 574 m² in the fourth sub-area to 1.386 m² in the first sub-area. The number of zones per homegarden ranged between four and six. All homegardens had a minimum of two zones, i.e. residential area and other places. Due to the large differences in homegarden size, the average value for each zone as a percentage of the total area should be used with caution. For example, as homegarden size increases, the percentage of the area allocated to the residential area decreases. In the first sub-area where there is a relatively large size of homegarden, 26 % of the total area was allocated to the residence, while in the fourth sub-area; the residence comprised 47% of the total area.

A correlation analysis of zones indicated positively significant relationships between the total area of homegarden and areas allocated to: residential area ($r = 0.75$, $p < 0.01$); fruit trees area ($r = 0.78$, $p < 0.01$); vegetable area ($r = 0.36$, $p < 0.01$); pulses area ($r = 0.64$, $p < 0.01$); other crops area ($r = 0.48$, $p < 0.01$) and other places ($r = 0.24$, $p < 0.05$).

The location of zones in the most homegardens was delineated. The farmers chose particular areas for different zones. For example, vegetables were planted closest to the residential areas in order to facilitate the ease of continuous practices such as watering and weeding. The fruit trees zone was farthest from the residential area, since they need less daily work.

Table 7: Zonation in homegardens.

Sub-areas	Different zones in homegardens												Average area (m²)	
	Residential		Fruit trees		Vegetables		Pulses		Other crops		Other places			
	m²	%	m²	%	m²	%	m²	%	m²	%	m²	%	m²	%
Sub-area 1	357	26	552	40	250	18	114	8	53	4	54	4	1386	100
Sub-area 2	345	36	330	33	122	12	90	9	30	3	72	7	990	100
Sub-area 3	307	41	180	23	110	14	30	11	30	4	55	7	767	100
Sub-area 4	269	47	62	11	125	22	38	7	30	5	50	8	574	100

3333 Demographic and literacy

Altogether 483 individuals (53 % male) with average of 6 members per family were contained the family structure of the homegardens. Age distribution shows 15 % of individuals below age 10; 29 % between ages 11-19; 21 % between ages 20-29; 14 % between ages 30-39 and 21% above age 40. Data inspection on literacy shows that 90 % of the individuals below age 40 are able to read and write but this ability for individuals above 40 years old was 56 %.

3334 Occupations

The following occupations were reported by 78 percent of the sample population: 1) farmer, 2) animal husbandry, 3) homegardener, 4) student, 5) housekeeper, and 6) miscellaneous jobs. The remaining 22 percent of the population were children below the age 6, and persons unemployed. All children below age 10 and 89 % between 11-19 years old reported as students. Homegardens were the second most frequent activity for women after housekeeper and third for men after animal husbandry and fieldwork. Most of the women more than 20 years old (87 %) were involved in household and homegarden routine activities, apart from other works and only 13 % of them work outside. The men work more frequently outside of the household than women. Outside work was limited to working in small stores, official works and small workplaces.

3335 Labor input

Total average of labor input in homegardens shows large variations between different sub-areas (Figure 22). The homegardens in the first sub-area that received high levels of labor input (68 h/month) are larger in size and play an important role in vegetable and fruit production. But in the fourth sub-area labour input is minimum (13 h/month) because of small size of homegardens and low agricultural activities in homegardens. Labor input by gender was varied, but in all sub-areas women worked proportionally more than men. The woman/man labor input ratio in the first sub-area is 1.61 and this ratio increases to 1.75, 2.14 and 3 in the second to fourth sub-areas respectively. It seems in lower sub-areas, where homegardens play an important role in generation of income, men participate in most of homegardens activities. In the other sub-areas the men normally participate in land preparation and fruit harvesting, with the women doing the rest.

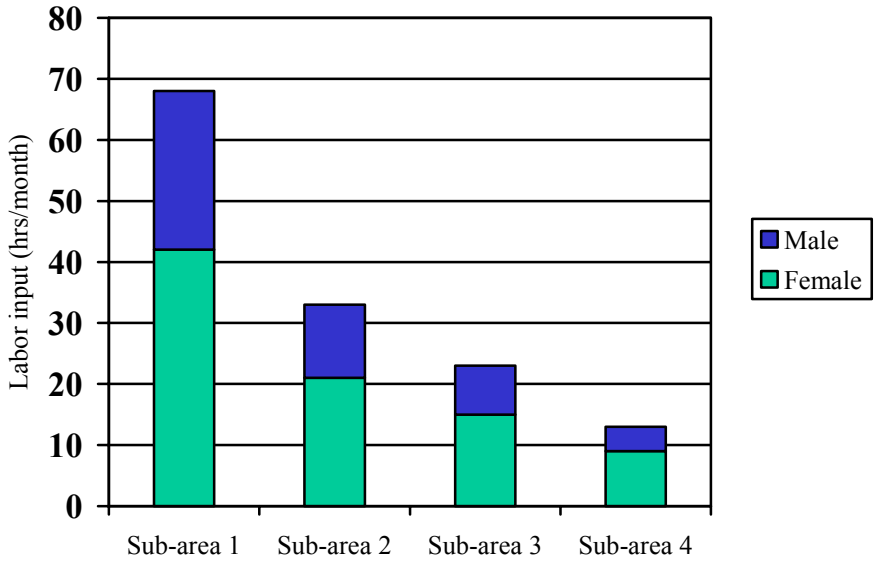

Figure 22: Labor input by gender in homegardens.

3336 Destiny of Products

Destiny of products is shown in Table 8. Most products obtained from homegardens were used for home consumption, only surplus was sold on local markets. Important commercial products, mainly in the first and second sub-areas were different varieties of citrus fruits, garlic, summer squash and beans. White mulberry was another common tree in homegardens, with the leaves used to feed silkworms. Most of the other products were mainly used for family consumption.

Table 8: Destiny of plant products in homegardens.

	Home consumption (%)				Sale (%)			
	Sub-area 1	Sub-area 2	Sub-area 3	Sub-area 4	Sub-area 1	Sub-area 2	Sub-area 3	Sub-area 4
Vegetables	69	91	94	94	31	9	6	6
Fruits	44	79	94	100	56	21	6	0
Pulses	79	86	87	98	21	14	13	2
Others	98	100	100	100	2	0	0	0

3337 Income generation

Six main sources for generating of income were identified (Table 9). The percentage of income that was derived from homegardens in the first sub-area ranks third after animal husbandry and fieldwork activities. But this source of income is the fifth rank in second and third sub-areas.

Animal husbandry is the first source of income in all sub-areas except in sub-area 4. In this sub-area, outside work is the first source of income. The percentage of total income from homegardens was reduced from 16 % in the first sub-area to only 2 % in fourth sub-area. The main reasons for this are the reduction in size of areas that are allocated to fruits, vegetables and pulses on one hand, and the inappropriate environmental conditions in high lands for agricultural activities on the other.

Table 9: Percentage of total income by source.

Sub-area	Source of income (%)					
	Homegarden	Field work	Animal husbandry	Commerce	Outside work	Others
1	16	22	27	11	18	6
2	9	27	30	13	15	5
3	6	23	30	15	20	7
4	2	16	17	18	29	18

3338 Classification of homegardens

Cluster analysis based on agroecologic and socioeconomic variables could identify six types of homegardens (Table 10).

Table 10: Classification of homegardens based on cluster analysis.

Type and numbers	Homegarden No.[1]	Variables (Average per type) [2]				
		Z	U	S	I	T
A (11)	1,7,10,20,22,24,25,29,39,45,58	6.4	3.4	13	13.6	1245
B (12)	2,4,19,21,31,34,35,38,41,42,48,60	5.5	2.5	8.8	18.8	893
C (7)	3,6,8,9,13,15,27	6.6	3.6	17.9	19.3	1886
D (7)	5,12,17,18,33,40,55	5.9	2.9	14	12.1	1171
E (42)	11,16,23,26,28,30,32,36,37,43,44,46,47,49 50,51,52,53,54,56,57,59,61,62,63,64,65,66 67,68,69,70,71,72,73,74,75,76,77,78,79,80	5.5	2.6	7	2.9	613
F (1)	14	6	3	15	25	2500

[1]Numbers of 1-20 homgardens in sub-area 1, 21- 40 homegardens in sub-area 2, 41- 60 homegardens in sub-area 3 and 61- 80 homegardens in sub-area 4. [2] Z: Total number of zonation; U: Total number of plant uses; S: Total number of plant species; I: Percentage of total income from homegarden; T: Total area (m^2).

Type A contains medium sized homegardens with a medium number of species but a high number of zones and plant uses. This type is fruit gardens (without any kind of vegetables) or mixed home gardens (with fruits and vegetables) that are mainly located in the first and second sub-area. Families in this group obtain income from their homegardens more than families in groups E and D, but less than others. The most important sources of income for families in this type of homegardens were animal husbandry and fieldwork.

Type B was relatively small homegardens with a low number of plant species, but nevertheless they produce 18.8 % percent of total family income. This type was fruit or mixed homegardens, on which most of its land was allocated to fruit or vegetable production. The production of these homegardens was sold in local markets. The distribution of this type in the first three sub-areas was more and less equal but there is no homegarden from this type in the fourth sub-area.

Type C homegardens were relatively large homegardens with the highest number of species. The number of zones and plant uses was larger than the mean of the sample. This type was mainly located in the first sub-area, was produces 19.3 % of the total family income.

Type D was homegardens with medium size and number of species and a relatively high number of zones and plant uses. Although this type of homegardens is bigger than type B, the percentage of income from this type is lower than type B. The main reason is that as the number of species in these homegardens is greater, each individual species receives less space. There are seven homegardens in this type, 4 in the first sub-area, 2 in the second sub-area and 1 in the third sub-area. There are no fruit trees in homegardens that were belonging to this type and they are as such vegetables gardens.

Type E homegardens were the smallest in total area and percentage of income from homegardens (2.9 %). Products of this type were mainly used for home consumption. The total number of species in this type was relatively low although the total number of uses and the total number of zones were close to the sample mean (2.8 and 5.8 % respectively). A high percentage of total homegardens (52.2 %) is located in this category and the distribution of this type of homegarden in different sub-areas shows 4.5 % in sub-area 1, 16.5 % in sub-area 2, 31 % in sub-area 3 and 48 % in sub-area 4.

There is only one homegarden in type F that is located in the first sub-area. This mixed homegarden was largest in size, high number of zones, medium number of species and relatively low number of uses. 64 % of the total area of this homegarden was allocated to fruit trees, which amounted for 90 % of the sale in local markets, and generated 25% of total family income.

334 Discussion

Labor input was highly variable and dependent on the size and type of the homegarden. In the first and second sub-areas, labor input was higher than in the other areas. Most of the homegardens in these sub-areas were large in size and normally played an important role in the generation of income for families. In these homegardens men participated more than in other homegardens with women. Although the number of zones in different sub-areas is more or less the same, in the lowlands a large area of each homegardens was allocated to the commercial production of fruit, vegetable, or pulses, the majority of which is sold at local markets. In highlands especially in the fourth sub-area, homegardens do not have a significant income-generating role, but instead provide a space for relaxation, socializing, and as a safe playground for children.

The quantity of labor invested in homegardens was not related to the size of the family but depended significantly on the type and size of the homegarden. The average labor input was 16, 5.6, 3.2 and 1.6 h/week in sub-areas 1-4, respectively. The labor input was similar to labor investment reported in homegardens of several Asian countries, Mexico and Peru which ranged between 13-110 man-days/year (approximately 2-17 h/week) (Torquebiau 1992, Hoogerbrugge and Fresco 1993) and greatly less than labor investment reported (32.6 h/week) in homegardens in Nicaragua (Méndez et al. 2001).

Most of families prefer that children devote their time to school work, and they only ask for help in vacations and especially during summer for harvesting. Most of

people that work in homegardens were older than 30 and the younger people normally were not interested in working in homegardens.

Whereas most part of homegarden production is for family consumption, any marketable surplus can provide valuable cash income for families (Price 1983, Colfer et al. 1985, Corlin et al. 1989, Padoch and de Jong 1991, Shalaby 1991). A cluster analysis with different agroecologic and socioeconomic variables clearly could identify properties of homegardens. 52.2 % of the studied homegardens were situated in type E. In general this type included homegardens with small total area and low number of species and almost all parts of products used for home consumption. A huge portion of this type of homegardens was located in sub-area 4, where homegardens were the least frequent activity for both men and women, and produced only 2 % of the family income. The most important reasons were improper environmental conditions for most of plants and less availability of flat lands in this sub-area. This source of income for other sub-areas was also not as high (see Table 6). In Nicaragua, homegardens can contribute up to 100 % of total income, although the average income from homegardens was 35 % (Méndez et al., 2001). A study in West Sumatra estimated that a hectare of homegarden produces 365-500 US$ per year and that the garden's cash value is equal to 60 percent of annual rice production (Michon et al. 1986) and could be up to 625 US$ in Mexico (Alvarez-Buylla Roces et al. 1989). In Vietnam, the income derived from homegarden products is often three times more than the income from the rice fields (Linh and Binh 1995). In general homegardens do not play a large role in generation of income for most of the Iranian families, however, it seems particularly important especially in types of F, C and D.

Cluster analysis put only one homegarden in type F because of high differences between this homegarden and other's from variables, this used in cluster analysis.

This investigation was an attempt to study the interaction between agroecologic and socioeconomic factors and showed that these factors are effective in management, plant uses and species diversity in homegardens. In order to better understand these relationships further studies are necessary.

335 Summary

Biodiversity and plant uses of homegardens in each area depend on ecologic and socioeconomic characteristics. Relationships between agroecologic and socioeconomic aspects of homegardens were studied at Savadkouh / Iran. Four sub-areas according to different altitudes including twenty villages were visited. Altogether eighty homegardens (four in each village) were visited randomly and complete information on socioeconomic factors; plant species diversity and their uses were collected through direct observation of homegardens and interviews with farmers. Six different zones were recognized. Residential area, fruit trees, vegetables and pulses were the most important zones. The number of zones per homegarden ranged between four to six. In total seventy-eight plant species with 4 different groups of uses were identified. Plant diversity was highest for fruits (35 species), followed by vegetables (29 species), pulses (8 species) and finally other crops with 6 species. The average homegarden's area in different sub-areas varied between 574 m² in the fourth sub-area to 1386 m² in the first sub-area. Working in the homegarden was the second most frequent activity for women after housekeeping and the third most for men after animal husbandry and fieldwork. Most of the women (87 %) were more than 20 years old and involved in household and homegarden routine activities, apart from other

work and only 13 % of them work outside. Labor input by gender varied, and in all sub-areas women worked extensively in homegardens. Most of the products that were obtained from homegardens were used for home consumption and surplus was sold in on local markets. The percentage of total income from homegardens varied from 2-16 % of total income in the different sub-areas. Six types of homegardens were identified by cluster analysis based on agroecologic and socioeconomic variables.

34 Checklist of cultivated plant genetic resources*

341 Introduction

Although the checklists are often used for area surveys of wild plants, cultivated plants are included in some cases. Botanical checklists are useful tools in research on cultivated plants (Hammer 1990) and the specific methods are described elsewhere (e.g., Hammer 1991).

The checklist allows for characterization of the state of plant genetic resources in a particular area. A printout of the checklist can be used in later fieldworks. Later on, the checklist can be printed to facilitate the management of plant genetic resources and the exchange of information between interested persons and organizations.

342 Methodology

The explorations for plant genetic resources were undertaken in April / May 2004 in twenty villages (homegardens and fields) and the surrounding areas of Savadkouh (Figure 2, Table 2). Agricultural and horticultural plants of the area have been considered.

To obtain a deep and quick inside into the crop plants of this area, the checklist method (Hammer 1991) was used. This method has been previously employed in similar situations in other parts of the world, e.g., in Libya (Keith 1965, Hammer and Perrino 1985, Hammer et al. 1988), Cuba (Esquivel et al. 1989, Hammer et al. 1989a, Hammer et al. 1990a), Korea (Hoang et al. 1988, Hammer et al. 1989b, Hoang et al. 1997), Southern Italy and Sicily (Hammer et al. 1990b, 1992) North and central Italy (Hammer et al. 1999a), Ustica/Italy (Hammer et al. 1999b) and Balad Seet/Oman (Hammer et al. 2004).

All cultivated plants of the area are included with the exception of ornamental and forest plants, which have no other agriculture and horticultural uses. Therefore, the inclusion of the plants into the list follows the same principles as the Mansfeld-List (Schultze-Motel 1986).

The different uses of plants are indicated in order of their importance. The parts used are given in brackets. The following abbreviations are used for uses and plant parts (according to Hammer et al. 1992, 1999).

C. = cereals	(b.) = bulbs
Fi. = fibre crops	(ba.) = bark
Fo. = fodder crops	(fl.) = flowers
Fr. = fruits	(fr.) = fruits
I. = industrial crops	(h.) = herb
M. = medicinal plants	(l.) = leaves
N. = nuts and related	(r.) = roots, rhizomes
Oi. = oil crop	(st.) = stem
Pu. = pulses	(w.) = wood

* This part of the study was submitted as an article for Environmental Sciences journal (Khoshbakht and Hammer, submitted).

Sp. = spices and condiments (s.) = seed
St.= starch plants, excl. cereals
V. = vegetables

Some local names added, taken from Esmail Zahedi, *Vaze-name-ye giyahi* (1958), Hosayn Golegolab, *Gia Rahnema-ye giyahi* (1961), Ali zargari, *Giahan-e darui* (1976-1980), Valiollah Mozaffarian, *A Dictionary of Iranian Plant Names* (1998) and personal investigations. The synonyms were mainly added from the related literatures (e.g., Rechinger 1963-2001, Parsa 1940-1960, Assadi 1988-2003).

Short notes are given concerning the evolution of species and their status quo in the research area. The notes also reflect folk uses of these plants.

343 Results

3431 Checklist

The checklist is an important result of our work. More than 85 species of cultivated crop plants are indicated for this geographic region.

Actinidia deliciosa (A. Chev.) C.F. Liang & A.R. Ferguson in Guihaia 4 (1984) 181
A. chinensis Planch. in Hook., Lond. J. Bot. 6 (1847) 303
A. latifolia Merr. var. *deliciosa* A. Chev. in Rev. Bot. App. Agric. Trop. 20 (1940) 12, pl. I, II
A. chinensis Planch. var. *deliciosa* (A. Chev.) A. Chev. in Rev. Bot. Agric. Trop. 21 (1941) 241, pl. I
A. chinensis Planch. var. *hispida* C.F. Liang in Acta Phytotax. Sin. 13 (1975) 33
(Actinidaceae)
F. (fr.)
Kiwi کیوی
Introduced to Iran in recent years and some gardens established in north of Iran. Some single trees exist in the homegardens of the Savadkouh area.

Allium cepa L., Sp. Pl. (1753) 300
A. ascalonicum L., Amoen. Acad. 4 (1759) 454
A. esculentum Salisb., Prodr. (1796) 235
Cepa vulgaris Renault, Fl. Dép. Orne (1804) 33
(Liliaceae)
V. (b., l.), M. (b. , l.)
Peiyaz پیاز
Originated in central Asia, west Asia, and Mediterranean coastal and adjacent regions. A mix of new inbred varieties and local varieties are under cultivation.

Allium paradoxum (M. B.) G. Don , Monograf. Allium:72 (1827)
Scilla paradoxa M. B., Fl. Taur.-Cauc. 3:267 (1819)
(Liliaceae)
V. (b.,l.)
Alezi الزی

Cultivated rarely in homegardens as a vegetable. Wild plants commonly collected from the wild and used in several local foods.

Allium porrum L., Sp. Pl. (1753) 296, s.l.
(Liliaceae)
V. (b., l.)
Ghandna گندنا ; Taree faranghi تره فرنگی
Cultivated as a vegetable.

Allium sativum L. Sp. Pl. (1753) 296, S.l.
Porrum sativum (L.) Rchb., Fl. germ. exc. (1830) 110 non Mill. (1768)
(Liliaceae)
Sp. (b.), V. (b., l.), M. (b.)
Sir سیر
Several local races and cultivars cultivated in this area.

Allium kurrat Schweinf. ex K. Krause
(Liliaceae)
V. (l., b.)
Taree تره ; Taree irani تره ایرانی
Local varieties of this narrow-leaf vegetable are cultivated in homegardens and small fields.

Anethum graveolens L., Sp. Pl. (1753) 263
A. sowa Roxb. ex Flem., As. Res. 11:156 (1910)
Peucedanum graveolens (L.) Benth. & Hook. f., Gen. Plant. 1:919 (1867)
(Apiaceae)
V. (l.), Sp. (l.), M. (fr.)
Shveid شوید ; Shbet شبت
Possibly originated in the eastern Mediterranean and adjacent southwest Asia. Cultivated as a spice and medicinal plant in ancient Egypt, Greek and Roman antiquity. Leaves and fruits used as flavouring. Cultivated as a vegetable and condiment. The fruits serve as a condiment and are also used medicinally.

Apium graveolens L., Sp. Pl. (1753) 264
A. lobatum Gilib., Fl. lit. inch. 2 (1782) 41
A. celleri Gaertn., Fruct. sem. pl. 1 (1788) t. 22
Sison ruta Burm.f., Fl. indica (1768) 7
Seseli graveolens Scop., Fl. carniol. ed. 2, 1 (1771) 215
(Apiaceae)
V. (l., r.), M. (r., f), Sp. (l.)
Karafs کرفس
Originated probably in the middle of the 16th cent. in Italy. Inbred varieties cultivated in homegardens for the fleshy petioles. Fruits are used medicinally and as flavouring since for many generations in Iran (Aitchison 1890, Hooper and Field 1937).

Armeniaca vulgaris Lam., Encycl. 1:2 (1783)
A. Armeniaca Huth in Helios 11 (1893) 123
Prunus armeniaca L., Sp. Pl. (1753) 474
(Rosaceae)

F. (fr.), M. (fr.), Sp. (fr.)
Zardalo زردآلو
Cultivated in warm temperate to subtopic regions of all continents with centres in E Asia, Middle Asia, Caucasus, Iran, S Europe, and southern USA. Locally adapted races developed in suitable ecogeographic regions, e.g. in Middle Asia, the Caucasus and Iran.
Dry fruits and the seeds, if sweet, can be used like almonds as a nut.

Beta vulgaris L., Sp. Pl. (1753) 222
B. maritima L., Sp. Pl. ed. 2 (1762) 322
B. vulgaris L., Sp. Pl. ed., 2 (1762)
(Chenopodiaceae)
I. (r.),V. (l., r.)
Choghondar gand چغندر قند
The earliest written documentation on beet cultivation comes from eighth century BC Babylonia (Körber-Grohne 1987). Roots and young leaves are used in preparation of several local foods.

Brassica napus L., Sp. Pl. (1753) 666
B. oleifera Moench, Methodus (1794) 253
B. praecox Waldst. & Kit. apud Schult., Obs. bot. (1809) 131
Napus oleifera (Moench) Schimp. & Spenn. in Spenn., Fl. Frib. 3 (1829) 940
(Brassicaceae)
Oi.(s.)
Golza کلزا
Rape is known only as cultivated plant, which sometimes escapes from cultivation and occurs as weed. There are innumerable cultivars of this species.

Brassica rapa L., Sp. Pl. (1753) 666
B. tuberosa Salisb., Prodr. (1796) 272
Raphanus rapa (L.) Crantz, Class. Cruc. (1769) 113
(Brassicaceae).
V. (r.), M. (r.)
Shalgham شلغم
The cultivated turnip is subsp. *rapa* with a tuberous tap-root. The roots are used as vegetable, mainly boiled.

Borago officinalis L., Sp. Pl. (1753) 137
(Boraginaceae)
M. (fl.)
Gol-e gav-zaban گل گاوزبان
Cultivated in small field for medicinal uses. The corollas are used as a sedative tee.

Capsicum annuum L., Sp. Pl. (1753) 188
(Solanaceae)
V. (fr.), Sp. (fr.)
Felfel sabz فلفل سبز ; Felfel ghermez فلفل قرمز
Fresh fruits are used as vegetable and dried ones as spices and condiment.

Cerasus mahaleb (L.) Miller, Gard. Dict. ed. 8, Cerasus No. 4 (1768)
C. fontanesiana Spach, Hist. Vég. Phan. 1:410 (1834)
Prunus mahaleb L., Sp. Pl. (1753) 474
Padus mahaleb (L.) Borkh. ex Roemer, Arch. Bot. 1, 2:38 (1797)
(Rosaceae)
Mahlab محلب
Mainly used as rootstock for cherries.

Cerasus vulgaris Mill., Gard. Dict. ed. 8 (1768) Cerausus no. 1
Prunus cerasus L., Sp. Pl. (1753) 474 p.p. *typical*
P. recta K. Koch, Deutsch. Obstgeh. (1876) 165
Fr. (fr.)
(Rosaceae)
Albalo آلبالو
Fruits are edible and used to preparation of marmalade.

Cicer arietinum L., Sp. Pl. (1753) 738
C. grossum Salisb., Prodr. Strip. (1796) 340
C. sativum Schkuhr, Handb. (1808) 367
C. physodes Reichenb., Fl. Germ. Excurs. (1830) 532
C. rotundum Jordan ex Alef., Österr. Bot. Zeitschr. (1859) 356
(Fabaceae)
Pu. (s.), M. (s.)
Nokhod نخود
Cultivated in homegardens and fields.

Citrus aurantiifolia (Christm. & Panz.) Swingle in J. Wash. Acad. Sci. 3 (1913) 465
C. acida Roxb., Fl. ind. ed. 2, 3 (1832) 390, pp.
C. limonellus Hassk. in Flora 25 (1842) Beibl. 43
C. excelsa Wester in Phil. Agric. Rev. 8 (1915) 26
(Rutaceae)
Fr. (fr.)
Limo torsh ليموترش ; Limo omani ليموعمانى
Fresh fruits are used in production of soft drinks or for the extraction of citric acid. The fruits are eaten preserved in syrup, salt and vinegar. They are also consumed dried in different foods.

Citrus aurantium **L.**, Sp. Pl. (1753) 782, p.p., non Lour. (1790) et aut. nonnull.
Aurantium acre Mill., Gard. Dict. ed. 8 (1768) no. 1
C. florida Salisb., Prodr. (1796) 378
(Rutaceae)
Fr. (fr.), Sp. (fr.), M. (fr., s., fl.)
Naranj نارنج
The fruits serve in the production of soft drinks or juice consumed with salt and lettuce. The fruit, flower and seed are used medicinally. The petals are used in tea for flavoring. The sour orange is also used as a rootstock for other *Citrus* species.

Citrus limon Burm.f., Fl. ind. (1768) 173
C. limonum Risso in Ann. Mus. Paris 20 (1813) 201
Limon vulgaris Mill., Gard. Dict. ed. 8 (1768) no. 1

(Rutaceae)
Fr. (fr.), M. (fr.)
Limo shirin لیموشیرین
Cultivated as a fruit tree. The fruit juice is a rich source of vitamin C. The plant serves as a rootstock for other *Citrus* species.

Citrus reticulata Blanco, Fl. Filip. (1837) 610
C. nobilis Andrews, Bot. repos. 9 (1810) t. 680, non Lour. (1790) et auct.
C. chrysocarpa Lush. in Ind. Forester 36 (1910) 344
(Rutaceae)
Fr. (fr.)
Narangy نارنگی
Cultivated as a fruit tree in gardens and sometimes as a rootstock for other *Citrus* species.

Citrus sinensis (L.) Osbeck, Dagb. Ostind. resa (1757) 41, 98, nom.; Reise Ostindien (1765) 250; Pers., Synopsis 2 (1810) 74, quoad. syn. Mill.
Aurantium sinensis Mill., Gard. Dict. ed. 8 (1768) no. 2
(Rutaceae)
Fr. (fr.)
Portghal پرتقال
Cultivated as a fruit tree mainly in lowlands of area. The bark of the fruit is used to prepare marmalade.

Coriandrum sativum L.,Sp. Pl. (1753) 256
C. majous Gouan, Hort. Monsp. 145 (1768)
C. diversifolium Gilib., Fl. Lithuan. 2:26 (1782)
C. globosum Salisb., Prodr. Strip. 166 (1796)
C. melphitense Ten. & Guss., Ind. Sem. Horti Neap. 3 (1837)
Selinum coriandrum E.H.L. Krause in Sturm, Deutschl. Flora ed. 2, 12: 163 (1904)
(Apiaceae)
V. (l.), Sp. (l., fr., s.), M. (fr., l.)
Geshneiz گشنیز
Occasionally cultivated in homegardenns as a vegetable. Dried foliage and fruits are used as condiment or flavouring in soups, drinks and salads.

Corylus avellana L., Sp. Pl. (1753) 998
C. grandis Poir., Encycl. 4 (1798) 496
C. silvestris Salisb., Prodr. (1796) 392
(Betulaceae)
N. (fr.), Oi. (fr., s.)
Fandogh فندق
There are some plants in homegardens for home consumption.

Cucurbita maxima Duch.,Essai sur l'histoire naturelle des courges (1786) 7 , tab. et in Lam., Ecycl. 2 (1786) 151, non Wight & Arn. (1834)
C. potiro Pers., Syn. Pl. 2 (1807) 593
Pepo potiro (Pres.) Sag. In Ann. Sci. Nat., 1 sér., 8 (1826) 311
(Cucurbitaceae)
V. (fr.), M. (s.)

Kado-e-tanbal کدوی تنبل
Fruits are used in several local foods.

Cucurbita pepo L., Sp. Pl. (1753) 1010
C. verrucosa L., Sp. Pl. (1753) 1010
C. melopepo L., Sp. Pl. (1753) 1010
C. ovifera L., Mant. pl. 1 (1767) 126
(Cucurbitaceae)
V. (fr.)
Kado کدو
Cultivated as a vegetable. Fruits are used immature.

Cucumis sativus L., Sp. Pl. (1753) 1012
C. esculentus L., Salisb. Prodr. (1796) 157, nom. Illeg.
C. muricatus Willd., Sp. Pl. ed. 4, 4 (1805) 613
(Cucurbitaceae)
V. (fr.)
Kheiyar خیار
Fruits used mainly unripe in salads, pickled or salted. Only new varieties are under cultivation.

Cydonia oblonga Miller, Gard. Dict., ed. 8 (1754)
C. cydonia Persoon, Syn. Pl. 2 (1806) 40
C. communis Poiret in Duhamel, Tr. Arb. Arbust. éd. augm. 4 (1809) 135
C. maliformis Miller l. c.
C. vulgaris Pers., Syn. Pl. 2 in coring. (1807); Boiss.Fl. Or. 2: 656 (1872) et auct. nonn. Fl. Cauc. et Pers.
Pyrus cydonia L., Sp. Pl. 480 (1753); M.B.,Fl. Taur.-Cauc. 1: 391 (1808)
Sorbus cydonia Crantz, Stirp. Austr. fasc. 2 (1763) 57
(Rosaceae)
Fr. (fr.), M. (fr., l.)
Beh به
Selected types of quince can be used, as rootstocks for pears, inducing dwarfed growth, but not completely frost resistant. Quince cultivars are grafted on quince-seedlings, on poorer soils and also on hawthorn.

Daucus carota L. **subsp.** ***sativus*** (Hoffm.) Schübl. & Mart., Fl. Würtbg. (1834) 179
D. carota β L., Sp. Pl. (1753) 242
D. carota γ L., Sp. Pl. (1753) 242
D. carota var. *sativus* Hoffm., Deutschl. Fl. 1 (1791) 94
(Apiaceae)
V. (r.), M. (r., fr.)
Haveich هویچ
Cultivated as a vegetable in homegardens, uncommon.
subsp. *carota* and subsp. *maxima* (Desf.) Ball is native in the area and cultivated for its fleshy taproot (Hedge et al. 1987).

Diospyros kaki L. f., Suppl. Pl. (1782) 439
D. chinensis Blume, Catalogus (1823) 110, nom. nud.
D. schi-tse Bunge, Enum. pl. China bor. (1833) 42

Embryopteris kaki G. Don., Gen. hist. 4 (1837) 41
(Ebenaceae)
Fr. (fr.)
Khormalo خرمالو
Some trees exist in gardens.

Diospyros lotus L.*,* Sp. Pl. (1753) 1057
D. microcarpa Siebold in Ann. Soc. Hort. Pays-Bas (1844) 28, non Spanoghe (1835)
D. japonica Siebold & Zucc. in Abh. Math. Phys. Kl. Akad. München 4, 3 (1846) 136
Dactylus trapezuntinus Forssk., Fl. aegypt.-arab. (1775) 36
(Ebenaceae)
Fr. (fr.), M. (fr. l.)
Khormandi خرمندی
Wood used in construction and general carpentry. Mostly grown as a grafting stock for *D. kaki*.

Dracocephalum moldavica L., Sp. Pl. (1753) 595
Moldavica suaveolens Gilib., Fl. inch. 1 (1782) 79
M. punctata Moench, Methodus (1794) 410
(Labiatae)
M. (s., l.)
Baderanjboyeh بادرنجبویه
Cultivated in a few homegardens as a medicinal and aromatic plant.

Eriobotrya japonica (Thunb.) J. Lindl. in Trans. Linn. Soc. London 13 (1821) 102
Mespilus japonica Thunb., Fl. Jap. (1784) 206
(Rosaceae)
Fr. (fr.)
Azgil zaponi ازگیل ژاپنی
Cultivated in a few gardens as a fruit tree.

Eryngium sp.
(Apiaceae)
V. (l.)
Aweiyeh اویه
Cultivated in a few homegardens as vegetable. Leaves are used in several local foods.

Ficus carica L., Sp. Pl. (1753) 1059
F. kopetdagensis Pachom. in Vved.,Consp.Fl.Asiae Mediae 2:323 (1971)
F. communis Lam., Encycl. 2 (1786) 490
F. macrocarpa Gasp., Ric. caprifico (1845) 78, 79
(Moraceae)
Fr. (fr.), M. (fr., l.)
Anjer انجیر
Fruits are edible and consumed fresh or dry. They are used to prepare marmalade and sauce. The fruits, leaves and latex are used in folk medicine. The latex is also used to increase the tenderness of meat.

Foeniculum vulgare Miller, Gard. Dict. ed. 8 (1768) nr.1
F. officinale Ali., Fl. Pedem. 2:25 (1785)

F. piperitum (Ucria) DC., Proder. 4: 142 (1830)
Anethum foeniculum L., Sp. Pl. (1753) 263
(Apiaceae)
V. (l., h.), M. (s., h.), Sp. (s.)
Razieyaneh رازیانه
Cultivated in gardens as a vegetable, but apparently also as a wild plant. Foliage parts, fruits and roots are used in traditional medicine.

Fragaria* × *ananassa Duchesne in Lam., Encycl. méth. 2 (1786) 538
Fragaria tincta Duchesne in Lam., Encycl. méth. 2 (1790) 539
Fragaria hybrida Duchesne in Lam., Encycl. méth. 2 (1790) 540
Fragaria grandiflora Ehrh. in Beitr. Naturk. 7 (1792) 25
(Rosaceae)
Fr. (fr.)
Toutfarangy توت فرنگی
New cultivars cultivated and fruits are used as table fruit.

Fragaria vesca L., Sp. Pl. 494 (1753)
F. vesca α *sylvestris* L., Sp. Pl. (1753) 495
F. minor Duchesne in Lam. in Encycl. méth. 2 (1790) 531
(Rosaceae)
Fr. (fr.)
Toutfarangy vahshi توت فرنگی وحشی
Small, ovate, bright red, soft and aromatic fruits are used as table fruit.

Helianthus annuus L., Sp. Pl. (1753) 904
H. indicus L., Mant. Pl. 1 (1767) 117
H. pimilus Pres., Syn. Pl. 2 (1807) 475, nom. Invalid., non. Nutt. (1841)
(Asteraceae)
Oi. (s.), N. (s.), M. (s.)
Gol-e aftab gardan گل‌آفتاب گردان
Seeds are used fresh or roasted.

Heracleum persicum Desf. ex Fisch., C.A.Mey. & Avé- Lall.
(Apiaceae)
Golpar گپر
Cultivated in a few gardens, but mainly as a wild crop in this area. This is a magic plant. The farmers place the seeds into fire to protect them from evil eye. Young plants and flowering stem are eaten fresh or marinated. The young stem is used in the preparation of sourness.

Hordeum vulgare L., Sp. Pl. (1753) 84
H. hexastichon L., Sp. Pl. (1753) 85
H. distichon L., Sp. Pl. (1753) 85
H. aestivum Haller in Nov. Comm. Goett. 6 (1776) 6
(Poaceae)
Fo. (s., l.)
Jow جو

Mainly used as fodder crop for livestock. Formerly was used to prepare a special type of bread. Sometimes barley fields are used for grazing (before ear emergence). The grain yield is only slightly reduced.

Juglans regia L., Sp. Pl. (1753) 997
(Juglandaceae)
Fr. (fr.)
Found cultivated in a few gardens. Grafted on *J. nigra* L. rootstocks for cold and disease resistance.

Lactuca sativa L., Sp. Pl. (1753) 795
L. serriola var. *sativa* (L.) Moris, Fl. Sardoa (1840-43) 531, nom. inval.
L. scariola L. b. *hortensis* Bisch., Beitr. Fl. Deutschl. (1851) 190
(Asteraceae)
V. (l.)
Kahou كاهو
Cultivated as a vegetable in homegardens and fields.

Lens culinaris Medicus, Vorles. Churpf. Phys.-Oekon. Ges. 2: 361 (1787)
L. esculenta Moench, Meth. 131 (1794)
L. vulgaris Delarbre, Fl. Amer. 2:472 (1800)
L. sativa Hell., Fl. Wirceb. 2:169 (1811)
Ervum lens L., Spec. Plant. 738 (1753)
E. dispermum Roxb. ex Willd., Enum. Pl. Hort. Berol. 766 (1809)
(Fabaceae)
Pu. (s.)
Adass عدس
Local cultivars are still under cultivation.

Lepidium sativum L. ssp. ***sativum***
L. hortense Forssk., Fl. aegypt.-arab. (1775), p. LXIX
Thlaspi sativum (L.) Crantz, Stirp. austr. 1 (1762) 21
(Brassicaceae)
V. (l.), Sp. (l.), M. (l., s.)
Shahi شاهی ; Tartizak ترہ تیزک
Two subspecies are recognised that subsp. *sativum* cultivated as a vegetable and subsp. *spinescens* (DC.) Thell. is a wild plant in the arid areas of Egypt, Middle East up to the Iran and Anatolia. Cultivated in homegardens and used as vegetable, salad or spice and condiment.

Lycopersicon esculentum Mill., Gard. Dict. ed. 8 (1768) no. 2, nom. cons.
L. solanum-lycopersicum Hill, Hort. Kew. (1768) 148
L. galeni Mill., Gard. Dict. ed. 8 (1768) no. 1
Solanum lycopersicum L. Sp. Pl. (1753) 185
(Solanaceae)
V. (fr.)
Gojeh farangi گوجه فرنگی
Landraces with small fruits are still under cultivation. Modern cultivars are dominant.

Malus domestica Borkh., Theor.-prakt. Handb. Forstbot. 2 (1803) 1272
M. pumila Mill., Gard. Dict. Ed. 8 (1768) no. 3
M. pumila var. *domestica* Schneid., I11. Handb. Laubhk. 1 (1906) 715, f. 396
M. dasyphlla Borkh. var. *domestica* Koidz. in Act. Phytotax. Geobot. 3 (1934)189
Pyrus malus L., Sp. Pl. (1753) 479
Fr. (fr.)
Seib سیب
Cultivated as a fruit tree in some homegardens.

Malus orientalis Uglitzk. in Trudy Sev.-kavk. Inst. spec. techn. Kul't. 1, 3 (1932) 18
M. pumila Grossh., Fl. Kawk. 4: 287 (1935) et auct. Fl. Kawk. non. Miller (1768)
M. sylvestris L. ssp. *orientalis* (Ugl.) Browicz, Fl. Turkey 4: 158 (1972)
Pyrus malus auct. Fl. Kawk. non. L. (1753)
(Rosaceae)
Fr. (fr.)
Sieb سیب
The fruits are small (2-3.5 cm across), sour/sweet, more or less astringent and bitter. Seedlings are used as well-adapted rootstocks for *M. domestica* Borkh. Cultivated in a few homegardens for self-consumption.

Medicago sativa L., Sp. Pl. (1753) 778
Medica sativa (L.) Lam., Fl. franç. 2(1778) 584
Fo. (l.)
(Fabaceae)
Yonjeh یونجه
Cultivated as a fodder grass for animals and often escapes and naturalizes.

Mentha aquatica L., Sp. Pl. (1753) 576
M. aquatica var. *persica* Briquet in Paulsen, Bot. Tidskr. 28:245 (1907)
M. hirsuta Huds., Fl. angl. (1762) 223
(Labiatae)
V. (l.), M. (l.), Sp. (l.)
Poneh-e abi پونه آبی
Cultivated in gardens and also as a wild plant. Fresh and dried leaves are used in local foods as a condiment and flavour.

Mentha longifolia (L.) Hudson, Fl. Angl. 221(1762)
M. spicata L. var. *longifolia* L., Sp. Pl. (1753) 576
M. sylvestris L., Sp. Pl. ed. 2:804 (1763)
(Labiatae)
V. (l.), M. (l.), Sp. (l.)
Poneh-e ykrang پونه یکرنگ
Cultivated in gardens and also as a wild plant. Fresh and dried leaves are used in local foods as a condiment and flavour.

Mentha* × *piperita L., Sp. Pl. (1753) 576
M. nigricans Mill., Gard. Dict. ed. 8 (1768) no. 12
(Labiatae)
V. (l.), M. (l., h.)
Nanaa نعناع

Cultivated in homegardens and used as fresh and dried vegetable. The herbal part is used in preparation of beverage.

Morus alba L., Sp. Pl. (1753) 986
M. indica
M. tatarica Pall., Fl. Ross. 1, 2 (1784) 9, t. 2, non L. (1753)
M. rubra Lour., Fl. cochinch. (1790) 555, non L. (1753)
M. pumila Balb., Cat. pl. (1813) 52
(Moraceae)
Fr. (fr.), Fo. (l.), M. (fr.)
Tout-e safied توت سفید
The fresh and dried fruits serve as food. The plants are planted as shade trees in gardens and alongside of roads. The leaves are used in silk production.

Morus nigra L., Sp. Pl. (1753) 986.
M. scabra Moretti in Giorn. Ist. Lomb. Sci. Lett. Art. 1 (1841) 98
M. laciniata Mill., Gard. dict. ed. 8 (1768) no. 2
(Moraceae)
Fr. (fr.)
Tout-e siyah توت سیاه
The fresh and dried fruits serve as food. The plants serve as shade trees.

Ocimum basilicum L., Sp. Pl. (1753) 588
(Labiatae)
V. (l.), M. (l., s.)
Ryhan ریحان ; Tokhm sharbati تخم شربتی
Cultivated as a vegetable. The fresh or dried leaves used for flavouring soups, sauces and several local foods.

Olea europaea L., Sp. Pl. (1753) 8
Olea officinarum Crantz, Inst. rei herb. 2 (1766) 379
Olea pallida Salisb., Prodr. (1796) 13
(Oleaceae)
Fr. (fr.), Sp. (fr.), Oi.(fr.)
Zeitoun زیتون
Originated in Mediterranean coastal and adjacent regions. Pickled or otherwise prepared fruits are eaten as relish.

Oryza sativa L., Sp. Pl. (1753) 333
O. latifolia P. Beauv., Agrost. (1812) 27, non Desf. (1813)
C. (s.)
(Poaceae)
Berenj برنج
There are several inbred and local cultivars. Mainly cultivated in fields next to the rivers. Rice is the main staple food in this area. The straw is used to feed livestock. It is also used for basket making, for bags, sacks, hats and etc.

Panicum miliaceum L., Sp. Pl. (1753) 58
P. milium Pers., Syn. 1 (1805) 83

P. striatum Spr. Syst. veg. 1 (1824) 318
C. (s.)
(Poaceae)
Arzan ارزن
Seeds mainly used as food for pet birds and poultry. Formerly it was intensively cultivated and used in preparation of local foods. Today is an underutilized crop and observed only in a few homegardens. It grows as a weed in fields.

Petroselinum crsipum (Mill.) Nym. ex A.W. Hill, Hand-list herb. pl. Kew ed. 3 (1925) 122 Airy-Shaw in Kew Bull. (1938) 256
P. hortense Hoffm., Gen. Pl. Umbell. ed. 1:163, 1a, f. 7 (1814)
P. sativum Hoffm., l.c. ed. 2: 219 (1816)
P. anatolicum Freyn & Sint., Österr. Bot. Zeitschr. 44: 99 (1894)
Apium crispum Miller, Gard. Dict. ed. 8 Nr. 2 (1768)
A. petroselinum L., Sp. Pl. (1753) 264
(Apiaceae)
V. (l.)
Gafari جعفری
Used as both fresh and dried vegetable.

Phaseolus coccineus L. Sp. Pl. (1753) 724 var. ***albiflorus*** (DC.) Bailey, Sp. Pl. (1753) 724
(Fabaceae)
Pu. (s.)
Lobia لوبیا
Cultivated in gardens for home consumption.

Phaseolus coccineus L. ssp. ***coccineus***
Ph. coccineus L., Sp. Pl. (1753) 724
Ph.vulgaris L. var. *coccineus* L., Sp. Pl. Ed. 2 (1763) 1016
Apium crispum Miller, Gard. Dict. ed. 8 Nr. 2 (1768)
(Fabaceae)
Pu. (s.)
Lobia-e-gol لوبیای گل ; Lobia-e-ghermez لوبیای قرمز
Local races cultivated for home consumption. A neglected crop in this area.

Phaseolus lunatus L. Sp. Pl. (1753) 724, s.str. var. ***lunatus***
Ph. lunatus L.
(Fabaceae)
Pu. (s.)
Lobia لوبیا
Grown in gardens as a pulse. A neglected crop in this area.

Phaseolus vulgaris L., Sp. Pl. (1753) 723
Ph. nanus Juslen., Cent. Pl. I (1755) 23; L., Amoen. Acad. 4 (1759) 284
Ph. esculentus Salisb., Prodr. (1796) 335
Ph. lilac Zucc., Collect. (1809) 148
(Fabaceae)
Pu. (s.)
Lobia لوبیا

Cultivated in homegardens or small fields as a pulse. Wide spread in the area.

Pisum sativum L., Sp. Pl. (1753) 727 , s.l.; Makaševa in Fl. cult. pl. 4 (1979) 54
P. humile Mill., Gard. Dict. Ed. 8 (1768) no.2
P. arvense L., Sp. Pl. (1753) 727
(Fabaceae)
Pu. (s.)
Nokhod faranghi نخود فرنگی ; Nokhod sabz نخود سبز
Green immature pods and seeds are used as a vegetable. Dry and mature seeds are used as pulse.

Persica vulgaris Miller, Gard. Dict. ed. 8: no. 1 (1768)
Amygdalus persica L., Sp. Pl. (1753) 472
Prunus persica (L.) Batsch, Beytr. Entw. Pragm. Gesch. Nat.-Reiche 1: 30 (1801)
(Rosaceae)
Fr. (fr.)
Holo
Used as a fruit tree in gardens.

Prunus avium L., Fl. Suec. ed. 2 (1755) 165
Cerasus avium (L.) Moench, Methodus (1794) 672
(Rosaceae)
Fr. (fr.)
Gilas گیلاس
Cultivated as a fruit tree.

Prunus cerasifera Ehrh. **ssp.** ***macrocarpa*** Erëmin & Garkov
P.divaricata Ledeb., Ind. Sem. Hort. Dorpat. 6 (1824)
P. cerasifera Ehrh. Subsp. *Divaricata* (Ledb.) Schneider, Ill. Handb. Laubholz. 1:632 (1906) *P. phoeniocarpa* Hausskn. ex Bornm., Beih. Bot. Centrbl. 28, 2:227 (1911)
(Rosaceae)
Fr. (fr.)
Alocheh آلوچه
Cultivated in a few homegardens. Fruits are edible and used in several local foods. Wild mirobalan used as rootstock for *M. domestica* cultivars.

Prunus × ***domestica*** L., Sp. Pl. (753) 475
(Rosaceae)
Fr.(fr.)
Alo آلو
Fruits are suitable for fresh consumption. Dried ones used as condiment in local foods.

Punica granatum L.,Sp. Pl. (1753) 472
P. nana L., Sp. Pl. (1753) 472
P. spinosa Lam., Fl. Fr. 3 (1778) 483
Granatum punicum St.-Lag. in Ann. Soc. Bot. Lyon 7 (1880) 132
(Punicaceae)
Fr. (fr.), Sp. (fr., s.), M. (fr., l., fl., ba., r.)
Anar انار

Fruits are edible and used to prepare juice, sauce and sour candy.

Pyrus communis L., Sp. Pl. (1753) 479
Sorbus Pyrus Crantz, Stirp. Austr. fasc. 2 (1763) 56
Pyrus domestica Med., Gesch. Bot. (1793) 87
Pyrus sylvestris Moench, Meth. Pl. (1794) 679
(Rosaceae)
Fr. (fr.)
Golabi گلابی
Cultivated as a fruit tree.

Raphanus sativus L., Sp. Pl. (1753) 669
R. officinalis Crantz, Class. Cruc. (1769) 108
R. gayanus (Fisch. & Mey.) G. Don in Sweet, Hort. Brit., ed. 3 (1839) 44
(Brassicaceae)
V. (r., l.)
Torobche تربچه
Ocasionally planted in gardens.
Saccharum officinarum L., Sp. Pl. (1753) 54
S. officinale Salisb., Prodr. (1796) 17
Saccharifera officinalis Stokes, Bot. Mat. Med. 1 (1812) 131
(Poaceae)
Nishakar نیشکر
An underutilized crop in this area.

Salix aegyptiaca L., Cent. Pl. 1 (1755) 33
Salix nitida S. G. Gmel., Reise Russland 3 (1774) 283, t. 28
S. phalomoides M. Bieb., Fl. taur.-caucas. 2 (1808) 415 et 3 (1919) 628 pp.
(Salicaceae)
Bidmeshk بید مشک
Male catkins used to prepare beverage.

Sesamum orientale L., Sp. Pl. (1753) 634
S.indicum L., Sp. Pl. (1753) 634
S. trifoliatum Mill., Gard. dict. ed. 8 (1768) no. 3
S. malabaricum J. Burm., Fl. malab. (1769) 4
(Pedaliaceae)
Oi. (s.)
Ghonjed کنجد
Seeds are used in preparation of sweets, bread and cakes.

Setaria italica (L.) P. Beauv., Ess. Agrost. 51, 170, 178 (1812)
Panicum italicum L., Spec. Plant. 56 (1753)
(Poaceae)
C. (s.)
Gavras italiaei گاورس ایتالیایی
Cultivated in a few homegardens as food for cage-birds and poultry. Formerly the grain was used as human food. A rare crop in the research area.

Solanum melongena L., Sp. Pl. (1753) 186
S. sanctum L., Sp. Pl. ed. 2 (1762) 269
S. esculentum Dunal, Hist. Sol. (1813) 208,t. 3
(Solanaceae)
V. (fr.)
Bademjan بادمجادن
The fruits are eaten as vegetables prepared in many different ways.

Solanum tuberosum L., Sp. Pl. (1753) 185
S. esulentum Neck., Delic. Gallo-Belg. 1 (1768) 119, nom. illeg.
S. aracatscha Bess., Cat. Pl. Hort. Crem. (1816) 135
S. sinense Blanco, Fl. Filip. (1837) 137
Lycopersicon tuberosum (L.) Mill., Gard. Dict. ed. 8 (1768) no. 7
(Solanaceae)
V. (r.); St. (r.)
Seib zamini سیب زمینی
Originated in South America. Cultivated as a vegetable in homegardens and small fields.

Sorghum bicolor (L.) Moench, Meth. Pl. 207 (1794)
Holcus bicolour L., Mantissa Alt. 301 (1771)
Andropogon bicolor (L.) Roxb., Fl. Ind. 1:272 (1820)
(Poaceae)
Fo. (l.)
Sorghum سورگم
Cultivated as a fodder grass in fields.

Sorghum halepense (L.) Pers., Syn. Pl. 1:101 (1805)
Holcus halepensis L., Sp. Pl. (1753) 1047
Fo. (l.)
(Poaceae)
Sorghum سورگم
Cultivated as a fodder grass in fields.

Spinacia oleracea L., Sp. Pl. (1753) 1027
S. oleracea L. subsp. *orientalis* Girenko, Trudy Prikl. Bot., Genet. Selekcii 40: 35 (1968)
S. spinosa Moench, Meth.: 318 (1794)
S. domestica Borkh, in Rhein. Mag. 1 (1793) 481
(Chenopodiaceae)
V. (l.)
Sphenaj اسفناج
Probably introduced into cultivation in Iran in the late antiquity as ”ispany”. Distributed to the East to India and as Persian vegetable to East Asia. Introduced by Arabs to Spain in the 12th cent. From here distributed to other European countries.
The primitive races with spiny seeds and modern cultivars with round seeds were observed. The spinach used as potherb.

Trifolium repens L., Sp. Pl. (1753) 767, s. str.
T. anomalum Schrank. Pl. rar. Hort monac. (1819) t. 47

T. nothum Stev. In Bull. Soc. Nat. Moscou 29, 3 (1853) 137
(Fabaceae)
Fo. (l.), V. (l.), M. (l.)
Shabdar safid شبدرسفید ; Shabdar khzandeh شبدرخزنده
Cultivated as a fodder grass for animals. Sometimes young leaves used as vegetable.

Trigonella foenum-graecum L., Sp. Pl. (1753) 777
Buceras foenum-graecum (L.) All., Fl. Pedem. 1 (1785) 313
Foenum-graecum sativum Medik., Vorles. Churpf. Phys. Ges. 2 (1787) 383
(Fabaceae)
Fo. (l.), V. (l.), M. (fr.), Sp. (fr.)
Shanbalileh شنبلیله
Cultivated as a fodder plant. Young leaves used as vegetable. Dry fruits are used as condiment.

Triticum aestivum L., Sp. Pl. (1753) 85
T. compactum Host, Gram. Austr. 2 (1809) 5
T. hybernum L., Sp. Pl. (1753) 86
T. sativum Lam., Fl. franç. 3 (1779) 625, pp.
(Poaceae)
C. (s.)
Gandom گندم
Both new and some old varieties are cultivated.

Vicia faba L., Sp. Pl. (1753) 737
V. esculenta Salisb., Prodr. 339 (1796)
Faba vulgaris Moench, Meth. 150 (1794)
F. sativa Bernh., Syst. Verz. Erfurt 250 (1800)
(Fabaceae)
Pu. (s.)
Baghela باقلا
The domestication of this crop took place apparently in the Near Eastern-E Mediterranean region. It's very common plant in homegardens. Young pods with immature seeds are used as a vegetable in local foods. Dried and mature seeds are an important protein source and used in different soups. Boiled seeds are a special food in winters.

Vigna unguiculata (L.) Walp., Repert. 1(1842) 779
Dolichos unguiculata L., Sp. Pl. (1753) 725
(Poaceae)
Pu. (s.)
Lobia chashm bolboli لوبیا چشم بلبلی
Dried seeds are used in different foods and soups.

Vitis vinifera L., Sp. Pl. (1753) 202
V. laciniosa L., Sp. Pl. (1753) 203
V. vinifera L. var. *laciniosa* (L.) Fiori, Nuov. Fl. Anal. Ital. 2 (1925) 109
V. deliciosa Andrasovsky in Jávorka, Magyar Fl. (1924) 703
(Vitaceae)
Fr. (fr.), M. (s.)

Angor انگور
The berries are eaten fresh as table grapes or used in preparation of juice. Dry fruits as raisins or sultanas. Young leaves used in preparation of local foods. Verjuice prepared from immature fruits.

Zea mays L., Sp. Pl. (1753) 971
Z. americana Mill., Gard. Dict. ed. 8 (1768) no. 1
Z. vulgaris Mill., Gard. Dict. ed. 8 (1768) no. 3
Mays zea Gaertn., Fruct. sem. pl. 1 (1788) 6
(Poaceae).
C. (s.), Fo. (l.)
Zorat ذرت
Cultivated in gardens and small field around the household. Immature cobs and seeds are used as vegetable.

344 Discussion

To our knowledge, the present study is the first one carried out in this area. The checklist allows a characterization of the state of plant genetic resources on the area. An index of families and genera is shown in Table 11. Several local cultivars such as *Allium sativum*, *Lens culinarus*, *Oryza sativa*, *Punica granatum* and *Spinacia oleracea* still are under cultivation. But also genetic erosion was observed in this area with the replacing of landraces and local cultivars with new inbred cultivars. Therefore, an establishment of an effective program for the maintenance of plant genetic resources (PGR) is necessary. This program should be considered *ex situ* and *in situ* (Allard 1988, Rao and Hodgkin 2002) as well as *on-farm* germplasm management (Hammer et al. 2003b).

Landraces in many crops have been identified as the most threatened category of genetic resources and are also the primary object of demands for compensation (Fowler and Mooney 1990, Hawkes 1983). They were the initial targets of conservation, and conservation of these accessions of crop varieties in genebanks and botanical gardens (*ex situ* conservation) is useful to protect them from extinction. *Ex situ* conservation methods serve as a backup for PGR. *In situ* conservation is not so much a new idea as one, which has re-emerged after the successful certain of *ex situ* conservation (Zeven 1996). As the conservation of crop genetic resources has progressed, conservationists have concluded that *in situ* conservation is needed to complement gene banks and botanical gardens. Since *ex situ* conservation simply cannot capture or conserve all of the diversity in agricultural systems, *in situ* conservation serves as a necessary backup. It also covers types of genetic resources that cannot be protected in gene banks, such as crops that show recalcitrance to offsite conservation (Hammer et al. 1996), as well as local knowledge and ecosystem interactions (Brush and Stabinsky 1996, Oldfield and Alcorn 1987). *In situ* conservation does not directly provision genes for crop improvement but preserves evolutionary processes, which will yield new germplasm in the future (Brush 1995, Jarvis 1999, Jarvis and Hodgkin 1999).

On-farm management of PGR is a relatively new concept. There have been early proposals, e.g. by Kuckuck (1974), for the conservation of cereals fields together with wild relatives allowing genetic interchange in gene centers. However, only in the eighties of the last century was a broader attention given to on-farm conservation.

Proposal to conserve fields of einkorn (*Triticum monococcum* L.) and emmer (*T. dicoccon* Schrank) in Southern Italy (Perrino and Hammer 1984) and a Proposal to make the island of Linosa/Italy as a center for on-farm conservation of plant genetic resources (Hammer et al. 1997) are some examples of efforts for on-farm management of PGR.

A change in the way of thinking about *on-farm* conservation began in the tropical and subtropical areas, especially in the centers of diversity of cultivated plants (Altieri and Merrick 1987, Esquivel and Hammer 1988, Brush 1989).

To establish such programs some practical and scientific problems have to be solved. Economic convenience for local farmers, ways to guarantee the genetic integrity of landraces and relative equipment and management should be considered (Hammer et al. 1997). An attempt was made to introduce a methodology for on-farm conservation of plant genetic resources (Maxted et al. 2002). New methods have to be developed for a joint nature and traditional farm conservation. Genebanks should be integrated into these programs to guarantee the conservation of the rare and endangered species (Hammer 1999, Hammer 2003).

Savadkouh has suitable conditions for the domestication of wild species bringing them to local agriculture system. Homegardens provide a good content to study evolutionary processes of plant selection as people adapt plants to new and changing environments. Cuban homegardens are notable for the combination and adaptation of plants from different areas to the “conuco” system derived from the root and tree crop systems of the indigenous peoples (Esquivel and Hammer 1992a, 1992b).

Table 11: Index of families and genera. The plant families represented are listed in alphabetical order. For each family, the genera represented are also given alphabetically. The number of species per family or genus is noted in brackets, except for case of one species per family or genus. Inferaspecific taxa are not considered in the counts.

Actinidiaceae	-*Actinidia*
Alliaceae (5)	- *Allium* (5)
Asteraceae(2)	- *Helianthus*, *Lactuca*
Apiaceae (8)	- *Anethum*, *Apium*, *Coriandrum*, *Daucus*, *Eryngium, Foeniculum*, *Heracleum*, *Petroselinum*
Boraginaceae	- *Borago*
Brassicaceae (4)	- *Brassica* (2), *Lepidium*, *Raphanus*
Chenopodiaceae (2)	- *Beta*, *Spinacia*
Corylaceae	- *Corylus*
Cucurbitaceae (3)	- *Cucumis*, *Cucurbita* (2)
Fabaceae (11)	- *Cicer*, *Lens*, *Medicago*, *Phaseolus* (3), *Pisum*, *Trifolium, Trigonella*, *Vicia, Vigna*
Ebenaceae (2)	- *Diospyros* (2)
Juglandaceae	- *Juglans*
Labiatae (5)	- *Dracocephalum*, *Mentha* (3), *Ocimum*
Moraceae (3)	- *Ficus, Morus* (2)
Oleaceae	- *Olea*
Pedaliaceae	- *Sesamum*
Poaceae (9)	- *Hordeum*,*Oryza*, *Panicum*, *Saccharum*, *Setaria, Sorghum*(2), *Triticum*, *Zea*
Punicacea	- *Punica*
Rosaceae(14)	- *Armeniaca*, *Cerasus* (2)*, Cydonia*, *Eribotrya*, *Fragaria* (2), *Malus*(2), *Persica, Prunus* (3), *Pyrus*
Rutaceae (5)	- *Citrus* (5)
Salicaceae	- *Salix*
Solanaceae (4)	- *Capsicum, Lycopersicum*, *Solanum* (2)
Vitaceae	- *Vitis*

Cultivation of several wild fruit and shrubs was observed in homegardens. They have an important role in supplementing other foods as well as in enhancing the quality of the environment and nutrients can be obtained easily from the consumption of their harvest. Collection of wild foods from uncultivated lands may add significantly to the food security of poor rural households (Guijt et al. 1995). Cultivation of some of these gathered wild species (e.g. *Allium paradoxum* and *Eryngium sp.*) was started in few homegardens. This experimental cultivation is a first step for the domestication of these species.

Malus orientalis is distributed in the Caucasus, North of Anatolia, Armenia, Mountain belt in the northern part of Iran (Büttner 2001) and as well as in west, east and center of Iran (Sabeti 1997, Browicz et al. 1969). According to the rather wide distribution there is a high variability of vegetative and fruit characters. Therefore, *M.*

orientalis could have been also contributed to the domestication of the apple (*Malus domestica* Borkh.) by some character introgressions (Büttner 2001).

Prunus cerasifera Ehrh. ssp. *macrocarpa* Erëmin & Garkov is a deciduous thornless tree or shrub and is native in Caucasus, Asia Minor, Balkan Peninsula to Central Europe. The trees are apparently all self-incompatible, reproduce from seed and bear roundish, small (2 cm in diameter) yellow, red or dark red fruits, which taste very much like the cultivated plums (*P. domestica* L.). *Divaricata* wild forms fall into several eco-geographic races (Browicz et al. 1969, Khatamsaz 1992), among them *Prunus cerasifera* ssp. *macrocarpa* which occurs in the Caspian coast of Caucasia and Iran. Louneva (1999) has been given hybrids states to several taxa (e.g. *P.* × *nachitschevanica* Louneva = *P. cerasifera* × *P.* × *salicina* Lindl. , *P.* × *taurica* Luneva).

Punica granatum L. belongs to Vavilov's Centre of Origin IV, Central Middle East that includes the interior of Asia Minor, the Caucasus, Iran and the highlands of Turkmenistan. The wild forms of *P. granatum* grow in masses in the south Caspian belt, in northeastern Turkey, in Albania, and in Montenegro (Zohary and Hopf 1988, 2000). Cultivation of wild types of pomegranate with small, a sour and dehiscent fruit within homegardens is in the initial stages of domestication.

Evolutionary relations between wild and cultivated fruit trees and shrubs in the area have been observed and are in need of further study.

345 Summary

The Study area has been investigated for plant genetic resources. A checklist with more than 85 species comprises all found cultivated plants of the area with the exception of ornamental and forest plants, which have no other agriculture and horticultural uses. The checklist contains accepted botanical names, synonyms, family names, uses of plants and some additional notes mainly on present status of the plants.

Establishment of an effective program for maintenance plant genetic resources is necessary. This program should place attention on the three principal ways of germplasm management (i.e. *ex situ*, *in situ* and *on-farm*).

The study area has suitable condition for the domestication of wild species and their incorporation into local agricultural systems.

4 General conclusion and prospects for future research

Homegardens and local agricultural systems have been considered as as important components within larger agricultural systems. In these systems effective niches are provided for landraces of vegetables, pulses, fruit trees, and medicinal plants. Unfortunately, they have been neglected areas for research and development. Because information is so limited, more the scientific studies of these systems in this area as well as other parts of Iran are required. These microenvironments are containing underutilized and neglected plants and have been characterized as microcenters for agrobiodiversity. The conditions there allow conservation of locally and traditionally important species.

Traditional agricultural systems have been considered as important sites for domestication of wild varieties of species bringing them to local agricultural systems. Collection of wild foods from noncultivated lands may add significantly to the food security of poor rural households. Some of these gathered wild species become commonplace in homegardens after initial step of experimentation.

Finally, homegardens serve as entry points for the introduction of new varieties into the broader agriculture system. The plant species present in the homegardens also reflect the socioeconomic background of the farmers involved.

Besides local crops collected from the wild, many exotic species have also been introduced into homegardens. Some of them have adapted themselves to the local surroundings and may even contain new generic traits unique to the local plant varieties of area.

According to the this study and in order to fill some gaps of knowledge, the following recommendations and prospects for future research are proposed:

- Similar studies in other regions of the country that would be first nucleuses for preparation of a catalogue for cultivated plant genetic resources in country.

- Establishment of a computerized database for cultivated plants. This database facilitates the handling of data, the preparation of checklists and the different indexes.

- Establishment of an effective program for maintenance plant genetic resources. This program should be considered the three principal ways of germplasm management – *ex situ*, *in situ* and *on-farm*.

- Genetic diversity studies in different levels on ‘key species’. The key species should be selected regarding to different criteria such as distribution and particular importance.

- The evaluation of geneflow within homegardens and agricultural systems as well as study of geneflow from wild to cultivated plants and vice versa.

- The study of genetic erosion in landraces and local cultivates in different levels and ways to overcome situations, which increase genetic erosion.

- The assessment of relationship between homegardens and traditional agricultural systems. The contribution of these systems in conservation of plant genetic resources as well as domestication of wild related of cultivated plants should be considered.

- Continue in-depth socioeconomic studies. The study of socioeconomic factors influence on diversity of cultivated plants should be considered.

5 Summary

Agrobiodiversity in each area strongly depends on not only ecological conditions but also socioeconomic characteristics of farmers. Savadkouh area in northern Iran was selected for study of agrobiodiversity of cultivated plants with emphasis on socioeconomic aspects. This area with 2.078 km² and humid and semi-humid climatic conditions, cold winters, warm summers and mean annually rainfall 1.700 mm, is part of the Hyrcanian biomes and located between latitudes 36° 01' to 36° 42' north and longitudes 52° 46' to 53° 32' east. The main objectives of this study were identification and documentation of plant genetic resources in study area, better understanding of the knowledge of rural populations on wild fruit tree and shrub species and identify the potential of these species to improve nutrition and generate new income, conserve and protect the genetic resources and to contribute to a sustainable use of the natural resources, evaluation of homegardens' contribution in conservation, maintenance and domestication of plant genetic resources and classification of homegardens concerning to both socioeconomic and agroecologic variables.

Several preliminary missions and visits were carried out in study area between January to June 2003. These surveys followed by an intensive fieldwork in April/May 2004. Four sub-areas were selected according to the altitudes above sea level, which were, 1) lower than 500 m, 2) between 500-1000 m, 3) between 1000-1500 m, and 4) higher than 1500 m. In each sub-area five village and surrounding fields (totally twenty village) randomly were selected and visited. Complete information on diversity of cultivated plant species and uses of them and socioeconomic aspects of farmers, was collected through direct observation of homegardens and fields as well as interviews with farmers and local specialists. In addition to the data recorded directly by interviews, further information was registered from informal market surveys, local specialists and rural experts.

Altogether 172 accessions mainly in cereals, pulses and vegetables were collected. The selected accessions of collected seeds were sown later in greenhouse of the University of Kassel in Witzenhausen, Germany to classify and preliminary evaluation.

In order to study of uses of wild neglected fruit trees and shrubs in this area surrounding forests of villages were visited and altogether seventy-five interviews were carried out. The interviews were one-on-one and respondents carefully selected to represent both male and female but they had to be 40 or more years of age.

Eleven fruit tree and shrubs genera were identified in the north of Iran, which people used as a part of their diet regime. The most important fruit trees and shrubs were *Berberis sp.*, *Crataegus sp.*, *Ficus carica*, *Punica granatum* and *Rubus sp.* that most of them gather from the wild, or occasionally cultivate in homegardens. Evolutionary relations between wild and cultivated fruit trees and shrubs in the area have been observed and are in need of further studies.

Results of study was shown indigenous people living in rural areas depend on the wild fruit trees in their diet. They used them as table fruit, conserve, local food as well as folk medicine. The villagers often have considerable knowledge about wild fruit trees especially about use of them in treatment of sickness. Wild fruit trees have an vital role in supplementing other foods as well as in enhancing the quality of the environment and nutrients can be obtained easily from the consumption of these

fruits. Our results indicated that the fruits usually are collected freely from the natural forests. There is a need, however, to encourage their cultivation in home gardens or on farms alongside other crops. In this way harvesting can be done to supply the growers' needs and the surplus sold to improve household economy.

Interdisciplinary classification of homegardens was done according to both socioeconomic and agroecologic factors. Data analyses showed different types of homegardens (e.g., vegetable, fruit and mixed homegardens). Cluster analyses were run utilizing both socioeconomic and agroecologic variables, but maintaining the number of groups from the *a priori* field classification in order to contrast farmer's perceptions, based on the function of their homegardens, with statistical classifications. They were done using Ward's minimum variance method to identify homegarden types, with squared Euclidean distances used as a measure of dissimilarity. In this study, the most compatible statistical classification, which matched field-based functional classification in 81.3% of the cases, was used. This was obtained using the following variables, which were standardized to zero mean and variance one: 1) total area, 2) total number of zones, 3) total number of uses, 4) total number of species, 5) fruit trees area, 6) vegetables area, 7) pulses area, and 8) percentage of total income from homegarden. The contribution of these variables to the formation of clusters was ascertained through a stepwise, variable discriminant analysis. Between groups comparisons for each variable were evaluated with a one-way analysis of variance. Using cluster analysis six types of homegardens were identified.

A checklist of cultivated plants contains accepted botanical names, related synonyms, family names, local names, part and uses of plants and some additional notes mainly on present status of plants. The checklist allows a characterization of the state of plant genetic resources on the area.

Establishment of an effective programme for maintenance plant genetic resources (PGR) is necessary. This programme should be considered the three principal ways of germplasm management – *ex situ*, *in situ* and *on-farm*.

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