Journal of
AGROBIOLOGY

J Agrobiol **29**(2): 55–62, 2012
DOI 10.2478/v10146-012-0009-z
ISSN 1803-4403 (printed)
ISSN 1804-2686 (on-line)
http://joa.zf.jcu.cz; http://versita.com/science/agriculture/joa

ORIGINAL ARTICLE

Conservation status and sustainable local use of crop and crop wild relative species in the Bistoon protected area / West of Iran

Reza Rostami, Korous Khoshbakht

Department of Agroecology, Environmental Sciences Research Institute, Shahid, Beheshti University, G. C., Tehran, Iran

Received: 21st November 2012
Revised: 18th September 2013
Published online: 31st October 2013

Abstract
Collecting information about crop wild relatives (CWRs) as vital genetic resources for food security is the first stage of monitoring them. In this study, which was conducted in a protected area, we surveyed the conservation status of CWR sand, and the interaction between the condition of these plants and their local use. From 338 plant species in the area, 179 crop wild relatives in 38 families were identified. None of them is threatened, but some endemic rare or vulnerable plants such as *Alkanna frigida* Boiss. could cause some anxiety. Among these species 19 species of CWRs have edible usage in this area. Harvesting the crop wild relatives from nature by the local people is seen as a conservative factor although this is not usually true of other species.

Key words: monitoring; genetic resources; crop wild relative (CWR); protected area

INTRODUCTION

Crop wild relatives (CWRs) are important genetic resources to be used in plant breeding and some of them are suitable for direct exploitation through harvesting from nature. A wild species that is related to a species of direct socio-economic importance can be defined as a crop wild relative (Maxted et al. 2008). So CWRs may be important for societies with lower socio-economic status. The importance of *in situ* conservation is acknowledged by the international community and policy makers (Meilleur and Hodgkin 2004). To conserve and sustainably utilize crop wild relatives, we firstly need to identify their names, locations, threats and current conservation status. Information about the conservation status and utilization potential of crop wild relatives is diverse, and no particular established standard exists for representing such information, which is vital for the efficient conservation and utilization of these species (Moore et al. 2008). The creation of *in situ* conservation and management plans for PGR (Plant Genetic Resources) populations in existing protected areas can considerably enhance

✉ Reza Rostami, Department of Agroecology, Environmental Sciences Research Institute, Shahid Beheshti University, G. C., Tehran, Iran

Rezarostami19@gmail.com

their present conservation status (Maxted 2003). The importance of *in situ* conservation is sometimes more than *ex situ* conservation (Hammer 2004). *In situ* conservation of species allows adopting gradual changes, so they are able to show new variations in environmental conditions and biotic interactions (Jarvis et al. 2008). Studies and analyses of protected areas indicate that these areas have a very important role in the conservation of crops and their wild relatives (Stolton et al. 2006).The value of CWRs in protected areas as one of the important places for *in situ* conservation should be acknowledged in order to assist in the creation and development of protected areas and their managements for CWRs (Meilleur and Hodgkin 2004). However attention in protected areas is mostly given to animal species rather than the crop wild relatives (Cooper et al. 2001) and there are usually no management plans and political decisions to conserve these plant species (Maxted et al. 1997). The first component of management plans for crop wild relatives is the assessment of taxon, population and site. Genetic diversity should be assessed in order to identify the required conditions, and to develop monitoring approaches for the establishment of management targets (Maxted et al. 2008). The role of wild species in supplying nutrition in agricultural systems and natural ecosystems has been widely neglected by the agricultural and scientific communities. According to studies devoted to the assessment of CWRs, their utilization and local use is limited in Iran, and there is a patent need for more studies. This study was conducted firstly in order to evaluate the consumption of crop wild relatives and the ways in which they are used, and then to establish the need for conservation of these plants, after identification and assessment of their conservation status.

MATERIAL AND METHODS

Study area

The study was conducted in the Bistoon protected area located in the Kermanshah province of Iran (Fig. 1). This 54,663 ha mountainous rolling land has been protected since 1967. The altitude range of 1300–3380 m, and mean annual precipitation and temperature of 700 mm, and 7 °C respectively, have resulted in cold Mediterranean and temperate sub-humid climates. The occurrence of many plant species exhibits the high biodiversity of the region and its importance as a genetic reserve. *Prunus amygdalus* Batsch., *Pistaca* sp., *Rosa canina* L., *Prunus cerasus* L., *Cotoneaster* sp., *Taeniatherum caput-medusae* (L.) Nevski, *Glycyrrhiza globra* L. and *Ranunculus abortivus* L. are some of the plant species of the region.

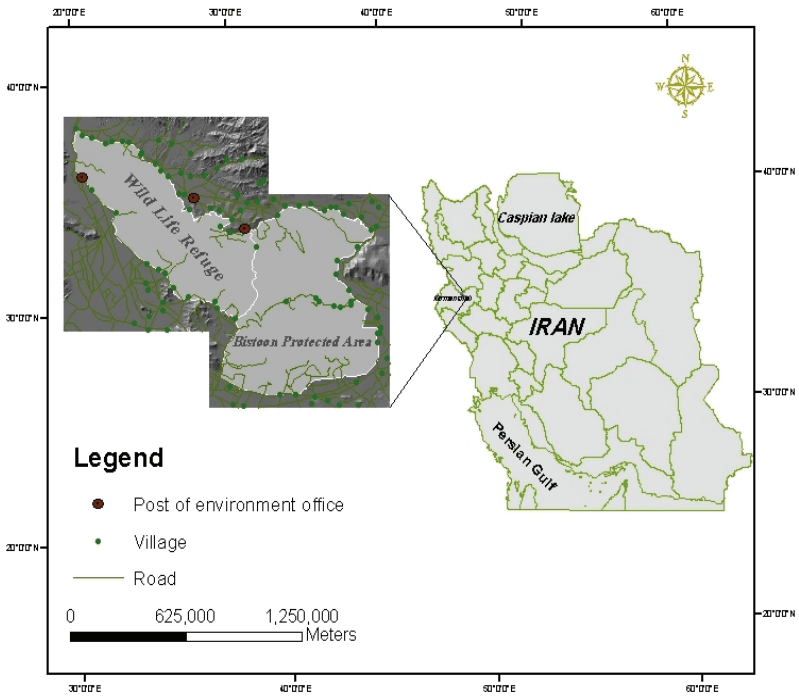

Fig. 1. Map of survey area: location of Bistoon protected area

Methodology

The study was conducted during September 2010. In order to provide a complete list of crop wild relatives of the area, we first of all gained access to the list of plant species which is presented in management plans of the Bistoon protected area and then made our own direct observations of the plant species including sampling and recognition. Also, in order to complete the list of CWR and crops, the local people and farmers were questioned. A list of crop wild relatives and the number of their related crops was provided by of Mansfeld's Encyclopedia (Hanelt and Institute of Plant Genetics and Crop Plant Research 2001). To obtain a list of threatened crop wild relatives at the species level, the Red Data Book of Iran (Jalili and Jamzad 1999) was used. The precise scientific names of the studied plants were searched for in the web site of The International Plant Names Index (IPNI). The list of plants utilized was provided by questionnaire and interviews with observers in the Bistoon protected area in addition to perusal of the Introduction to the Edible Autophytes of the Kermanshah Province (Maassoumi 2002).

RESULT AND DISCUSSION

Conservation status

The crops of Bistoon area are divided into two: 12 horticultural plants and 10 agronomic plants (Table 1).

Table 1. Crops and their wild relatives in the studied area

Family	Taxa (Crop)	Crop wild relative(s)
Anacardiaceae	*Mangifera* L.	–
Chenopodiaceae	*Beta vulgaris* L.	–
Compositae	*Carthamus tinctorus* L.	*Carthamus lanatus* L., *Carthamus oxyacantha* M. Bieb.
Cruciferae	*Brassica napus* L.	–
Graminaceae	*Hordeum vulgar* L.	*Hordeum glaucum* Steud.
	Triticum aestivum L.	–
	Oryza sativa L.	–
	Zea mays L.	–
Juglandaceae	*Juglans* L.	–
Papilionaceae	*Cicer arientium* L.	–
	Ervum lens L.	–
	Medicago sativa L.	*Medicago radiate* L., *Medicago rigidula* (L.) All.
Rosaceae	*Armenica* Duh. L.	–
	Cerasus avium Monch.	*Cerasus microcarpa* Boiss.
	Cerasus vulgaris L.	
	Malus Mill L.	–
	Persica miller L.	–
	Persica nucipersica Borgh. L.	–
	Prunus L.	–
Solanaceae	*Solanum lycopersicum* L.	–
	Solanum melomgena L.	–
Vitaceae	*Vitis vinifera* L.	–

We do not include plants that are not common as cultivated plants into the list of Bistoon protected area's crops; for example in many gardens *"populous albavar"*. is cultivated as a windbreaker and as well as an ornamental plant, but here it is not in the list of crops. Wheat and rape seed are cultivated parochially and maize is grown both for forage and seed usage. Some of the horticultural plants in this area have subspecies or cultivars but in this study only the names of the main species are presented. The number of cultivated plants estimated in other protected areas in Iran is 41 species (Hashemi et al. 2010), but Bistoon is a mountainous area and the number of its crops is lower because of the limited availability of flat land suitable for cultivating.

There is some symmetry in the frequency of crop wild relatives in the main families and the scattering of the total plants in the area. Thus the family Compositae has the highest percentage of both the total number of plants and crop wild relatives (Fig. 2).

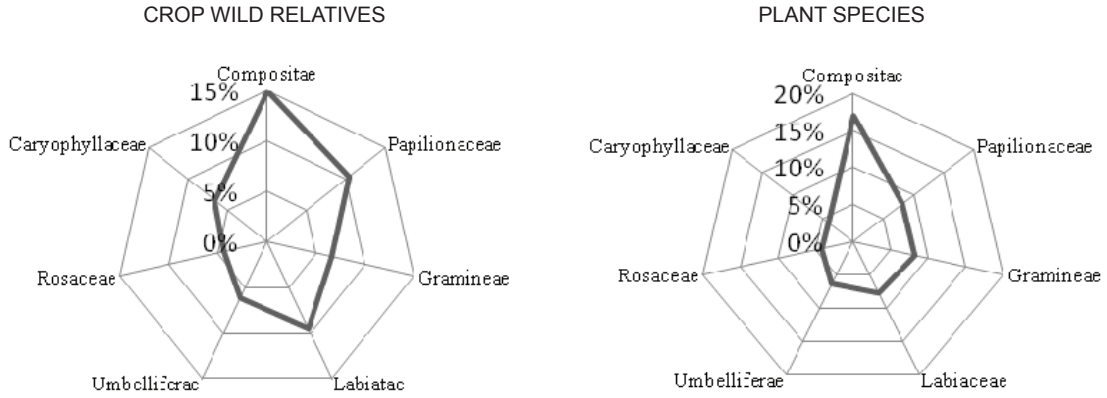

Fig. 2. Frequency of the plant species and crop wild relatives among total plants of the studied area

Among 388 plant species, 36 trees and shrubs species, 125 annual species and 227 perennial species are available. From this complex, 42 species are endemic, which indicates the importance of protecting of its genetic reservation. From the total of plant species in this area 179 species involving 38 families are Bistoon's crop wild relatives, and they are presented in Table 2.

Among Bistoon's CWRs, one species is vulnerable (*Alkanna frigida* Boiss.), 4 species are rare (*Ungernia flava* Boiss. & Hausskn., *Acanthophyllum microcephalum* Boiss., *Acanthophyllum kurdicum* Boiss. & Hausskn., *Ferula pseudoalliacea* Boiss.), and 12 species are in the low risk group. In addition to the suitable weather conditions that create normally stable circumstances, the fact that crop wild relatives of Bistoon protected area are in a mountainous impassable area, also establishes a comfortable conservation status. So, the exploitation of CWRs species for food or medicine is less possible for collectors of such plants. In a similar study conducted in Portugal, 216 CWR species were examined. 48 species were assessed as endangered and 43 as vulnerable (Maxted et al. 2008). As the number of CWR species in Bistoon protected area is a little less than the number in Portugal, it is obvious that the condition is more normal for Bistoon's plants than that of the CWR species of Portugal. Another study in Bolivia has revealed that a total of 152 species from 38 families were evaluated using the IUCN Red Listing Criteria. 7 of these were listed as being Critically Endangered (CR), 22 Endangered (EN), 16 Vulnerable and 20 Near Threatened (UNEP 2009). The National Bureau of Plant Genetic Resources (NBPGR) reported 320 species of crop wild relatives in India; these species were threatened by habitat destruction, compared to other species and extreme utilization (Stolton et al. 2006). Many of these species were endemic and grew in limited areas so they would be at risk of extinction, and this indicates that the Bistoon protected area could also be at risk if there is no solid management plan to protect its crop wild relatives.

Table 2. List of endemic crop wild relatives and their conservation status in Bistoon protected area

Name of family	Genus and species(CWRs)	Number of related crop species	Threatened	Form of life
Amaryllidaceae	*Ungernia flava* Boiss. & Hausskn.	1	R.	P.
Boraginaceae	*Alkanna frigida* Boiss.	1	Vu.	P.
Campanulaceae	*Campanula candida* A. DC.	1	–	P.
	Campanula humillima A. DC.	1	–	A.
	Campanula perpusilla A. DC.	1	–	A.
Caryophyllaceae	*Acanthophyllum caespitosum* Boiss.	1	–	P.
	Acanthophyllum microcephalum Boiss	2	R.	P.
	Acanthophyllum kurdicum Boiss. & Hausskn.	2	R.	P.
	Dianthus macranthoides Hausskn. ex Bornm.	2	LR.	P.
	Dianthus tabrizians Bienert ex Boiss.	2	LR.	P.
	Dianthus persicus Hausskn	2	LR.	P.
	Silene aucheriana Boiss.	2	LR.	P.
Compositae	*Helichrysum artemisioides* Boiss & Hausskn.	2	LR.	P.
	Scorzonera mucida Rech.f., Aellen & Esfand.	3	LR.	P.
Labiatae	*Satureja bachtiarica* Bunge.	6	LR	P.
	Satureja edmondii Briq.	6	LR	P.
Liliaceae	*Fritillaria straussii* Bornm.	6	LR.	P.
Papilionaceae	*Astragalus neo-mozaffariani* Maassoumi.	13	–	P.
	Astragalus straussii Bornm.	5	–	P.
	Onobrychis melanotricha var. *kermanensis* Sirj. & Rech.f.	5	LR.	P.
Rosaceae	*Potentilla pannosa* Boiss. & Hausskn.	2	LR	P.
Umbelliferae	*Ferula pseudoalliacea* Boiss.	6	R	P.
	Pimpinella deverroides Boiss.	6	LR	P.

Local use

Local people in the Bistoon protected area utilize a high number of the wild plants growing within this area and this creates a good situation for the development of ethnic and botanic knowledge about their usage. Harvesting from nature is carried out from the end of winter to the end of autumn of the next year. Harvesting is from May to July for species whose top branches, leaves, seeds or fruits are used raw or cooked. After that, the species whose fruits are used will be harvested. The total number of wild edible species is 32 the used parts of which are roots, leaves, stems or fruits and their usage can be medicinal, edible or both.19 species of edible plants in this area are categorized into the CWR list (Table 3).

Table 3. Crop wild relatives under local use in Bistoon protected area

Family	Taxa (CWR)	Uses type[1] (parts used[2])	Way of consumption
Boraginaceae	*Anchusa italic* var. kurdica Gusuleac (Retz.)	Fd. (l., st.)	Raw or baked with egg and yoghurt
Compositae	*Echinops ritrodes* Bunge.	Fl. (fl.)	Raw, when the flowers aren't formed
	Scorzonera papposa DC.	Ve. (r.)	Raw, after cleaning its brown skin
	Scorzonera lanata (L.) Hoffm.	Ve. (r.)	Raw, after cleaning its dark skin
	Scorzonera pseudolanata Grossh.	Ve. (r.)	Raw, after cleaning its dark skin
Euphorbiaceae	*Chrozophora hierosolymitana* Spreng.	N. (s.)	In its raw state as nuts
Labiatae	*Stachys lavandulifolia* Vahl.	Fl. (h.)	Dried leaves are used in foods as flavor
	Salvia palaestina Benth.	N. (s.)	Raw
	Salvia syriaca Gouan ex Benth.	N. (s.)	Raw
	Ziziphora capitata L.	Fl. (l.)	Powdered leaves are used in food as flavor
Papilionaceae	*Trigonella monantha* C.A.Mey.	Fd. (l., st.)	Young leaves are used in gravy before producing the fruit
Polygonaceae	*Rheum ribes* L.	Ve., Fd. (st.)	Raw or in gravy
Rhamnaceae	*Rhamnus persica* Boiss.	Ve. (fr.)	Fruits are fed
Rosaceae	*Cerasus microcarpa* Boiss.	Ve. (fr.)	Sour fruit are fed
	Amygdalus lycioides Spach.	N. (S.)	Cooked or raw
	Amygdalus haussknechtii (C.K.Schneider.) Bornm.	Fd. (fr.)	Cooked or raw
Thymelaeaceae	*Daphne mucronata* Royle.	Ve. (fr.)	Ripped red fruits are used in summer
Ulmaceae	*Celtisc aucasica* Willd.	Ve. (fr.)	Ripped sweet fruits are used in autumn
Umbelliferae	*Eryngium thyrsoideum* Boiss.	Ve. (st.)	The young stem's kernel that is still smooth and flexible is used in its raw state

[1] **Fl**, Flavours; **Ve**, Vegetable; **Fd**, Food additive; **N**, nuts

[2] (**fl.**), Flowers; (**fr.**), Fruits; (**h.**), Herb; (**l.**), Leaves; (**r.**), Roots, rhizomes; (**st.**), Stem; (**s.**), Seeds

The results show that using edible CWRs does not threaten the life of these species and it can even play an effective part in their survival. The reason for this is that the edible plants are not exhaustively harvested by the native people and after harvesting, some plants are left in each spot for seeding which permits the plants to be harvested again the next year. Also there is no plowing necessary in the production of edible plants; other advantages are the creation of shelter from predators and rising biodiversity. Although grazing does not usually require tending, where there are edible plants, grazing will be with surveillance. A study in western Africa shows that farmers maintain the diversity of the cultivated species by using their wild relatives. It enables the conservation of the wild species (Scarcelli et al. 2006). At the same time, in Africa, traditional vegetables harvested from nature represent a valuable resource, and are extremely important for human nutrition. They are also a source of income throughout the continent (Chweya and Eyzaguirre 1999). Harvested plants from the wild and wild types can be easily seen in Italian vegetable markets (Bianco 1995) and this has a noticeable effect on maintaining these plants and improving their conservation status. Another study on the conservation of wild plants within farming systems in Italy notes the use of wild relatives and their maintenance on the

farmland from which they came (Maxted et al. 2008). In Turkey, prohibiting livestock grazing led to the extinction of *'Aegilopstanschii'* from its natural habitat after three years (Karagoez 1998). Livestock grazing helps to spray wild species seeds and continue their survival in the wild. However, utilizing the CWRs species is not always a helpful element in their conservation. Another study throws some doubts on the efficacy of utilization of wild species in the conservation of these species. Lange (1998) reported that collection from the wild was a major source of medicinal and aromatic plants and some species were threatened by trade. So the conservation effect of utilizing crop wild relatives is dependent on the amount gathered.

The taxon information contains data fields for describing information about an individual CWR taxon and identification of the relationship between a crop and its wild relative (Maxted et al. 2006) which can be used for designing suitable and provident management plans. For example the vulnerability of a species indicates the sensitivity of its conservation needs. Now if this plant is an edible or a medicinal species, the importance of conservation will rise because of the role of that species in providing food and medicine in addition to its being a crop wild relative. This study shows that the use of crop wild relatives by native users is a kind of conservation. It is noticeable that we discovered that none of the edible crop wild relatives in the Bistoon protected area used by the people of many other areas, is threatened, and all of them have normal status. As long as utilization of CWRs species is limited to local use, there is no risky option for them. But, for example, if these plants are used for example as medicinal materials, they will be exposed to extreme harvesting from nature and consequently, it will raise the risks. As the *in situ* and *ex situ* conservation of CWRs are neglected (Heywood et al. 2007) and on the other hand, there has been much emphasis on methods of conservation in ecosystems and natural habitats (Pickett et al. 1997, Sutherland 2000) we can say that protected areas are suitable places for the *in situ* conservation of crop wild relatives.

REFERENCES

Bianco VV (1995): Rocket, an ancient underutilized vegetable crop and its potential. Biol Conserv 50: 1–11.

Chweya JA, Eyzaguirre PB (1999): The biodiversity of traditional leafy vegetables. International Plant Genetic Resources Institute, Rome, Italy.

Cooper HD, Spillane C, Hodgkin T (2001): Broadening the genetic base of crop production. CABI Publishing, Wallingford.

Hammer K (2004): Resolving the challenge posed by agrobiodiversity and plant genetic resources-an attempt. Kassel University Press., pp. 146–149.

Hanelt P (2001): Mansfeld's encyclopedia of agricultural and horticultural crops. Springer, Berlin.

Hashemi F, Khoshbakht K, Mahdavi A, Veisi H, Liaghati H (2010): A survey of agrobiodiversity in Gachsaran county and influence of climatic factors. J Agroecol 2: 1–12.

Heywood V, Casas A, Ford-Lloyd B, Kell SP, Maxted N (2007): Conservation and sustainable use of crop wild relatives. Agr Ecosyst Environ 121: 245–255.

Jalili A, Jamzad Z (1999): Red data book of Iran. Research Institute of Forest and Rangelands (RIFR), Tehran.

Jarvis A, Lane A, Hijmans RJ (2008): The effect of climate change on crop wild relatives. Agr Ecosyst Environ 126: 13–23.

Karagoez A (1998): *In situ* conservation of plant genetic recourses in the Ceylanpmar State farm, In Zencicr N, Kaya Z, Anikster Y, Adams W T (eds.): The proceeding of International Symposium on *In Situ* Conservation of Plant Genetic Diversity, 1998, Central Research Institute for Field Crops, Turkey, pp. 125–139.

Lange D (1998): Europe's medicinal and aromatic plants: Their use, trade and conservation. TRAFFIC International, Cambridge.

Maassoumi MS (2002): Introduction of edible Autophytes of Kermanshah province. Cultural publishing of Kaosar, Kermanshah.

Maxted N (2003): Conserving the genetic resources of crop wild relatives in European protected areas. Biol Conserv 113: 411–417.

Maxted N, Hawkes JG, Ford-Lloyd BV, Williams JT (1997): A practical model for *in situ* genetic conservation. In Maxted N, Ford-Lloyd BV, Hawkes JG (eds.): Plant genetic conservation: The *in situ* approach. Chapman and Hall, London, pp. 540–592.

Maxted N, Ford-Lloyd BV, Jury S, Kell SP, Scholten M (2006): Toward a definition of a crop wild relative. Biodiv Conserv 15: 2673–2685.

Maxted N, Ford-Lloyd BV, Kell SP, Iriondo JM, Dalloo E, Turok J (2008): Crop wild relative conservation and use. CAB International Publishing, Wallingford, pp. 152–154 and 394–404.

Meilleur B, Hodgkin T (2004): *In situ* conservation of wild relatives: status and trends. Biodiv Conserv 13: 663–684.

Moore JD, Kell SP, Iriondo JM, Ford-Lloyd BV, Maxted N (2008): CWRML: representing crop wild relative conservation and use data in XML. Publish with Biomed Central, 1471–2105/9/116, University of Birmingham, UK.

Pickett STA, Ostfeld RS, Shachak M, Likens GE (1997): The ecological basis of conservation. Chapman and Hall, London, Programme, Nairobi, Kenya.

Scarcelli N, Tostain s, Vigouroux Y, Agbangla G, DainouO, Pham JL (2006): Farmers' use of wild relatives and sexual reproduction in a vegetatively propagated crop. The case of yam in Benin. Mol Ecol 15: 2421–2431.

Stolton S, Maxted N, Ford-Lloyd B, Kell SP, Dudley N (2006): Food stores: Using protected areas to secure crop genetic diversity. WWF arguments for protection Series. WWF, Gland, Switzerland.

Sutherland WJ (2000): The conservation handbook: Research, management and policy. Blackwell Science, Oxford.

UNEP (2009): CWR information management. UNEP/GETcropwildrelativesprojectinBolivia. (http://www.cropwildrelatives.org/fileadmin/www.cropwildrelatives.org/documents/CWR_Project_Newsletter_PT.pdf)