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Recognition of Endemic Plants in Zagros Region (Case Study: Lorestan Province, Iran)

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Abstract. The present study was carried out in the Hashtadpahlou and Sefidkoh mountains which are important vegetation regions in the western Iran, Lorestan. The endemic plants and their life form in these mountain regions were determined. From the view point of regional elements, plants of these regions belong to Irano-Turanian region. Totally, 86 endemic plants from 18 families were recognized. The results show that the important families are Asteraceae (20 species), Fabaceae (14 species), Lamiaceae (13 species). The highest number of species investigated for *Astragalus* genus (11 species). Life forms of the plant species of region include: geophytes 26.44%, therophytes 16.09%, hemicryptophytes 18.38%, chamaephytes 31.04%, phanerophytes 8.08% .The high frequency of chamaephytes and geophytes can be attributed to high altitude and cold climate. Generally, it can be declared that the habitats of these ecosystems have high diversity due to the presence of 87 endemic plants and this pattern resulted from climate conditions and geomorphology of territory.

Keywords: Endemic plants, Life form, Irano-Turanian, Zagros, Iran.

Introduction

Biological variation of plant species are important in plant ecological studies (MAHMOUDI, 2007) and what enhanced today the increasing importance of biological diversity is its role in maintaining the stability of ecosystems (ESMAEILZADEH & HOSSEINI, 2006). The composition of plant and animal in a given region is important for natural resources management (AKSOY & UZUN, 2011) and more accurate recognition plant and animal species provides suitable approach for better protection of ecosystems. Overpopulation, pollution, soil erosion, forest harvesting operation and other incorrect utilization of natural resources have caused many problems in the environment. To preserve these resources, one essentially uses the plants properly and to achieve this important matter, one should be aware of flora and its relationship with the environment. Endemic species are those plants that distribution is restricted only to a particular region (ANDERSON, 1994; BULUT & YILMAZ, 2010). In recent years, awareness of the importance and role in relation to endemic species in conservation planning has been rising (SLATYER, 2007). In general, studies of these plants are useful for :1) knowing vegetation in the past; 2) determining the relationship of taxonomy; 3) identifying floristic area; 4) determining the optimum planning the protected parts, and 5) prioritizing strategies for protection (DHAR, 2002). Each plant has the unique ecological range and can tolerate a certain rate of variation of environmental conditions (ZAREI & ASSADI, 2008).

Given the importance of plants in environmental studies, identifying vegetation cover of different areas could play significantly role in planning a variety of programs particularly in the preservation, restoration, management and identification of plant species, including endemic plants. Floristic studies in Iran for conservation of natural resources, biodiversity and making the management planning are concerned. Iran has one of the most attractive rich flora in the South - Western Asia, and this is because of the large area, diversity of climate and topography (GHAREMANINEJAD, 2010). Endemic plants are not few in Iran, so their study plays a significant role in the preservation of natural resources. In this regard, recognition of endemic plant species was carried out in Zagros zone, Western Iran.

Materials and Methods

Study site

To study the endemic plant in this region, the Hashtadpahlu and Sefidkoh mountains were selected. The Hashtadpahlu range (ABRARI & VEISKARAMI, 2001) is located in south-western of Khorramabd (Lorestan province) and the northern aspect of this mountain (3000 ha) was studied (latitude: 33° 13′, 33° 16′; longitude: 48° 23′, 48° 27′). Minimum and maximum elevations are 1000 and 2900 m above sea level, respectively. Another part of the study area is the Sefidkoh Mountains which positioned in the north-west of Khorramabad in Lorestan, including 1100km^2 area(latitude:48° 20′,47° 50′; longtitude:33° 30′,33° 45′) with elevation of 950-3060 m above sea level (VEISKARAMI, 2000). Annual mean of precipitation is about 400-500 mm and soil types belong to Entisols and Inceptisols orders (VEISKARAMI, 2000).

Data collection

In order to identify the flora in these regions, the collecting samples of all the existing plants was conducted in the growing season. To investigate plant species, the scientific resources of flora were used (GHAHREMAN, 1996; DAVIS, 1988; RECHINGER, 1998). The life form of plants was identified using the biological classification system of Raunkier (GHAHREMAN, 1996).

Results

Based on the study of vegetation, 86 endemic species belonging to 54 genera and 20 plant families were identified (Table 1). The results showed that the highest number of species belonged to Asteraceae (16 species), Fabaceae (14 species), Lamiaceae (13 species), in such way that these species consisted the 54.01% of total plants (Table 2). 72 perennial species (83.72%) and 14 annual species (16.28%) were identified which belonging to 19 families of dicotyledonous and 1 family of monocots (Table 3). *Astragalus* genus (Fabaceae family) had the highest number of species (11 species) in these regions (Table 1). In terms of the life form of plants, it was determined that 23 species of geophytes (44/26%), 14 species of therophytes (09/16%), 16 species of hemicryptophytes (39/18%), 27 species of chamaephytes (04/31%), 7 species of phanerophytes (05/8%) were presented in these areas (Fig. 1).

Table 1. List of endemic plants in mountains regions, Zagros, Western Iran

Family	Taxa	Life form	Duration
ARISTOLOCHIACEAE	*Aristolochia olivieri* COLLEGNO	Ge	P
BORAGINACEAE	*Lappula barbata* (M.B.) GURKE	Th	A
	Lappula sinaica (DC.) ASCHERSON ex SCHWEINF	Th	A
	Lappula spinocarpus (FORSSK.) ASCHERSON & O. KUNTZE	Th	A
	Myosotis Koelzii H.RIEDL.	Th	A
	Nonnea suchtelenioides H. RIEDL	Hem	P

	Onosma kotschyi BOISS.	Hem	P
	Onosma platyphyllum H. RIEDL	Hem	P
CARYOPHYLLACEAE	*Dianthus orientalis* ADAMS. ssp. *scoparius*	Ch	P
	Gypsophila persica BARKOUDAH.	Th	A
	Silene pseudaucheriana MELZH.	Ch	P
ASTERACEAE	*Anthemis cretica* L.	Ge	P
	Centaurea geluensis BOISS. & HAUSSKN.	Hem	P
	Centaurea koeieana BORNM	Hem	P
	Cephalorrhyncus rechingerianus TUISL.	Ge	P
	Cirsium spectabile DC.	Hem	P
	Cirsium bracteosum DC.	Hem	P
	Cousinia disfulensis BORM.	Hem	P
	Cousinia haussknechtii WINKL.	Hem	P
	Cousinia khorramabadensis Bornm.	Hem	P
	Echinops endotrichus RECH. f.	Hem	P
	Iranecio paucilobus (DC.)B.Nord.	Hem	P
	Helichrysum oligocephalum DC.	Hem	P
	Phagnalon persicum BOISS.	Hem	P
	Postia puberula BOISS. & HAUSSKN.	Ch	P
	Scorzonera calyculata BOISS.	Hem	P
ASTERACEAE	*Senecio pseudo-orientalis*	Hem	P
CRASSULACEAE	*Rosularia elymaitica* BOISS. & HAUSSKN.) BERGER	Hem	P
	Umblicus intermedius BOISS.	Ge	P
	Umblicus trapaeolifoius BOISS.	Ge	P
CRUCIFERAE	*Graellsia saxifragifolia* (DC.) BOISS. ssp *saxifragifolia*	Ch	P
	Hesperis odorata DVORAK.	Ch	P
	Hesperis kurdica DVORAK et HADAC.	Ch	P
	Physorhyncus chamaerapistrum BOISS.	Ch	P
	Sameraria stylophora (JAUB. & SPACH.) BOISS.	Th	P
CUSCUTACEAE	*Cuscuta kotschyana* BOISS.	Th	A
EUPHORBIACEAE	*Euphorbia craspedia* BOISS.	Th	A
FAGACEAE	*Quercus brantii* LINDL. var. *persica*	Ph	P
FUMARIACEAE	*Corydalis verticillaris* DC.	Ge	P
LAMIACEAE	*Cyclotrichum strausii* (BORNM.) RECH. f.	Ch	P
	Nepta humilis BENTH.	Th	A
	kotschyi BOISS *Nepta*	Ge	P
	Nepta ptraea BENTH.	Th	A
	Nepta strausii HAUSSKN. & BORNM	Th	A
	Phlomis anisodonta BOISS.	Ge	P
	Phlomis olivieri BENTH.	Ge	P
	Salvia reuterana BOISS.	Ge	P

	Salvia sclreolepis BERNM. ex HED	Ge	P
LAMIACEAE	*Scutellaria nepetifolia* BENTH.	Ch	P
	Stachys benthamiana BOISS.	Ch	P
	Stachys melampiroides HAND – MTZ.	Th	A
	Stachys perspolitana BOISS.	Th	A
FABACEAE	*Astragalus ochinops* Boiss.	Ch	P
	Astragalus baba- alliar PARSA	Ph	P
	Astragalus babakhanloui MASSOUMI & PODL.	Ch	P
	Astragalus bodeanus FISCHER	Ch	Ch
	Astragalus veiskarami Zarre,podlech& Sabatii.	Ch	P
	Astragalus ecbatanus BUNGE	Ch	P
	Astragalus galbineus MAASSOUMI	Ch	P
	Astragalus gaubae BORNM	Ch	P
	Astragalus ibicinus BOISS. & HAUSSKN	Ch	P
	Astragalus leonardii MAASSOUMI	Ch	P
	Astragalus ptychophyllus BOISS.	Ch	P
	Onobrychis melanotricha BOISS.	Ch	P
	L. *Ononis spinosa*	Ch	P
	Vicia kotschyana Boiss.	Ge	P
LILIACEAE	*Allium haemanthoide*s BOISS. & REUT. & REGEL	Ge	P
	*Allium laev*e WENDELBO & VON BOTHMER	Ge	P
	Allium jesdianum BOISS&BUSHE.	Ge	P
	Nectroscurdum koelzii WENDELBO.	Ge	P
PLUMBAGINACEAE	*Acantholimon brachystachys* BOISS.	Ch	P
	Acantholimon bromifolium BOISS. var. bromifolium	Ch	P
	Acantholimon eshkerensis BOISS. & HAUSSKN	Ch	P
PRIMULACEAE	*Dionysia haussknechtii* BORNM. & STRAUSS.	Ch	P
ROSACEAE	Amygdalus haussknechtii (C. K .SCHNEIDER) BORNM	Ph	P
	Amygdalus lycioides SPACH.	Ph	P
	Cerasus brachypetelum BOISS.	Ph	P
	Cerasus microcarpa (C. A. MEY) BOISS.	Ph	P
RUBIACEAE	*Galium ceratocarpon* BOISS.	Ch	P
SCRUPHLARIACEA	*Scrophularia nervosa* BENTH. ssp. *nervosa*	Ge	P
UMBELLIFERAE	*Beuplorum haussknechtii* BOISS.	Th	A
	Bunium luristanicum RECH. f	Ge	P
	Bunium rectangulatum BOISS. & HAUSSKN	Ge	P
	Ferula macrocolea (BOISS.) BOISS	Hem	P

Ph – phanerophyte; Th – therophyte; Ch – chamephyte; Hem – hemicryptophyte; Ge – geophyte; A – annual; P - perennial

Table 2. List of families and number of species in the studied regio

Family	No.Species	No.Species(%)
ARISTOLOCHIACEAE	1	1
BORAGINACEAE	7	8/14
CARYOPHYLLACEAE	3	3/45
ASTERACEAE	16	32/98
CRASSULACEAE	3	3/45
CRUCIFERAE	5	5/75
CUSCUTACEAE	1	1/15
EUPHORBIACEAE	1	1/15
FUMARIACEAE	1	1/15
FAGACEAE	1	1/15
LAMIACEAE	13	14/94
FABACEAE	14	16/09
LILIACEAE	4	4/59
PLUMBAGINACEAE	3	3/45
PRIMULACEAE	2	2/29
RANUNCULACEAE	1	1/15
ROSACEAE	4	4/59
RUBIACEAE	1	2/29
SCROPHOLARIACEA	1	1/15
UMBELLIFERAE	4	4/59

Table 3. Family, Genus and taxa in each plant group

Plant Group	Family	Genus	Taxa
Pteriphytes	0	0	0
Monocotyledon	1	2	4
Dicotyledon	19	52	82
Total	20	54	86

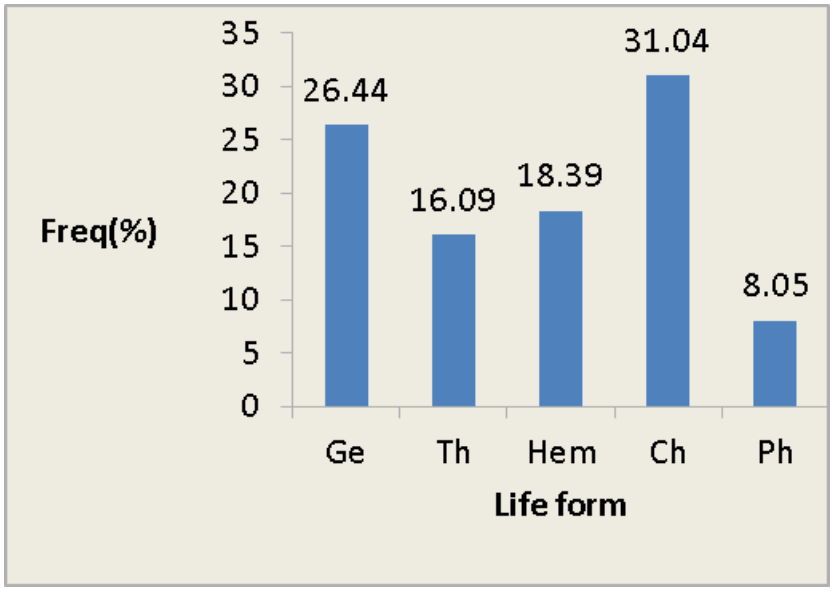

Fig. 1. Frequency of life form of endemic plants in region

Discussion

Identification of vegetation in given region and ecological analysis of their nature can help to detect the ecological characteristics and growth potential of the region (ESMAEILZADEH & HOSSEINI, 2006). Presence of 87 endemic species in these mountains is indicator for high plant biodiversity in these areas. The diversity in life form of plants of this region is the indication of adaptation to climatic and soil conditions. Life form of plants show taxonomic features of them and also indicates their adaptation to environmental conditions (ASRI, 2008).The high frequency of chamephytes and geophytes may be attributed to the high elevation and cold region that is consistent with SAFIKHANI *et al*. (2002) research. The high prevalence of chamephytes life form shows that agriculture operation is few in these zones. Chamephytes species, in the form of cushion and thorn, adapted to drought, high light conditions and winds (MEMARIANI *et al*., 2009).

The presence of hemicryptophytes is the sign of mountain areas. However, the lowest frequency of life form belong to phanerophytes , but this reflects suitable ecological conditions for the establishment of phanerophytes. The presence of *Astragalus* genus with 11 species reveal highland condition which is in agreement with ASSADI study (2009).The existence of species belonged to *Astragalus* genus such as *Astragalus anacardius* BUNGE., *Astragalus baba-alliar* PARSA, *Astragalus bodeanus* FISCHER and *Astragalus galbineus* MAASSOUMI is result of suitable condition in the Zagros region. Genus of *Astragalus* includes plants which produce gum tragacanth and so classified as medicinal plant (MAHMOUDI *et al*., 2009). The main feature of Irano-Touranian vegetation is the presence of species such as *Astragalus* and *Cousinia* genera (ASRI, 2008), and these two genera present within this region. The main reason for the dominance of Irano - Turanian vegetation in this region may be due to the remoteness of the area from other areas and particular environmental conditions (PAIRANJ *et al*., 2011). The presence of 86 endemic plants reflects the fact that there is high biodiversity within these habitats and this is due to climatic and geomorphology condition of their territory. The mountain areas due to the special geographical position and various environmental situations are rich regarding the existence of endemic plant species (IUSZ *et al*., 2011). High frequency of hemicryptophytes is clearly a sign of orophilous vegetation of endemic plants within these mountain ranges of Zagros region. MELENDO *et al*. (2003) stated that the frequencies of the hemicryptophytes in the Mediterranian region have been linked to increased rainfall and reduced heat.

The presence of therophytes plants can be an effective strategy to prevent water shortage due to reduced water and humidity (DA COSTA *et al*., 2007).In areas with winter rains, therophytes are more resistant to summer drought than hemicryptophytes and geophytes because the therophytes appear as the seeds but the hemicryptophytes and geophytes form vegetative organs in the summer (VAN DER MERWE & VAN ROOYEN, 2011).Since endemic species in these areas belong to Irano-Turanian vegetation elements ,so it can be stated that these areas(Hashtadpahlu and Sefidkaoh mountains) belong to the Irano-Turanian region of Iran. On the basis of the high number of endemic plants (86 species) in this region with small area, it should be declared that these habitats are a genetic reservoir for many species and it is necessary to protect these sites.

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