

Floristic characteristics of 2000 m altitudinal gradient of forest steppe in the Kuh-e Siah, Lendeh, SW Iran

Aliakbar Daneshi¹, Alireza Naqinezhad^{1*},
Azizollah Jafari Kookhdan² & Hamid Gholizadeh¹

¹ Department of Biology, Faculty of Basic Sciences, University of Mazandaran, Babolsar, e-mail: a.naqinezhad@umz.ac.ir (*corresponding author)

² Department of Biology, Faculty of Sciences, University of Yasuj, Yasuj.

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Abstract. Mt Kuh-e Siah of Lendeh in Dehdasht (Kohgiluyeh and Boyer Ahmad Province, SW Iran) is part of the Zagros Mountain Range with amplitude from 1000 m to 3000 m a.s.l. Floristic characteristics and vegetation structure of the mountain were surveyed during the growing seasons of 2011 and 2012. Altogether, 282 vascular plant taxa belonging to 198 genera and 65 families were identified in the area. *Asteraceae* and *Fabaceae* were the species-richest families. A floristic analysis indicated that hemicryptophytes were the predominating life forms in that mountain. Moreover, from phytogeographical point of view and despite the area's closeness to the Saharo-Sindian and Saharo-Arabian phytogeographical regions, Irano-Turanian elements were the dominant chorotype in the flora of the area. More importantly, 32 Iranian endemic species and 38 threatened plant taxa existed in that region. As the area is one of the least known and inaccessible points of the Zagros oak woodlands, the result of the current study could serve as a scientific backbone for biodiversity conservation of these important ecosystems.

Key words: altitudinal gradient, flora, oak woodlands, Zagros Range

Introduction

Among the countries of SW Asia, Iran is regarded as one with the most diverse vegetation and flora, mainly because of its climatic and geomorphological contrasts, as well as of the evolutionary potential of its flora (Frey & Probst 1986). Iran is known as a mountainous country with two major mountain ranges in the north (Alborz) and west (Zagros), and on the average with 60 % of the altitudes exceeding 1000 m a.s.l. (Noroozi & al. 2008). The Zagros Mountain Range holds one important center of plant endemism in Iran (e.g. Ghahreman & Attar 1999; Noroozi & al. 2018), and connects many Iranian provinces in West Iran at a distance of *ca.* 1300 km, with remarkable climatic variability but common dominant vegetation. It also belongs to the Irano-Anatolian Biodiversity Hotspot

(Groombridge & al. 2002). The vegetation of Zagros area includes a forest-steppe biome type (see Erdős & al. 2018) covered predominantly by *Quercus* trees, the so-called Zagros Oak Forests (Zohary 1973; Frey & Probst 1986; Sagheb-Talebi & al. 2014). The Zagros Forests comprise almost 40 % of all forested areas in Iran (Sagheb-Talebi & al. 2003, 2014). However, these forests are currently endangered by severe degradation and grazing (Asareh 2005). Traditional agriculture systems still operate in many parts of the understory of these forests (Sagheb-Talebi & al. 2003, 2014; Erdős & al. 2018).

Study of the flora and vegetation of the Zagros Mts dates back to Haussknecht in 1870, who collected a bulk of plant materials in the different mountain divides of the range (Ghahreman & Attar 1999; Akhiani 2006). The flora and vegetation in different parts

of the Zagros Range have been surveyed by other authors and published in various flora books, theses and monographs (see for examples Jafari Kookhdan 2002; Gheitouri 2003; Hamzehée & al. 2008; Sanandaji & Mozaffarian 2010; Dolatkahi & al. 2011; Pairanj & al. 2011; Shirmardi & al. 2011, 2014; Darvishnia & al. 2012; Ahmadi & al. 2013; Rostami 2013; Hassani & al. 2014; Mehrnia & Ramak 2014; Abasi & al. 2015). Within the Zagros range, Kohgiluyeh and Boyer Ahmad Province offers remarkable diversity of flora and vegetation. This is due to the two contrasting climate types there: the cold climate in the northern parts (“Sardsir”), and the warm climate in the southern parts of the Province (“Garmsir”), as well as to a remarkable altitudinal variability (from *ca.* 200 m a.s.l. in Gachsaran to *ca.* 4400 m at peak Dena). A floristic inventory of the Dena Protected Area located in the “Sardsir” part indicated 1250 plant species, or *ca.* 16 % of the entire Iranian flora, which represented a high potential of plant diversity of the mountains (Jafari Kookhdan 2002). It has been assumed that urgent investigation is needed of biodiversity and vegetation in the inaccessible and little-known parts of the Zagros Range, especially in the remote mountains of Kohgiluyeh and Boyer Ahmad Province. Mt Kuh-e Siah in Dehdasht could be regarded as the best example of such unknown and wild ecosystems. Mt Kuh-e Siah has rich plant diversity and is known as one of the most beautiful divers’ mountains in the Province. The current paper is aimed at providing information on the flora and habitats of this part of the Zagros Mts and at evaluating the life forms and chorology of plants there. It also strives to compare the obtained floristic results of the studied mountains with similar ecosystems in the Zagros Mts. Results of the current study will be particularly important for appropriate conservational decision-making in regard to the protected areas in the Zagros oak forests.

Material and methods

Study area

Mt Kuh-e Siah, with an approximate area of 7000 ha, is located in the 15 km to Lendeh (Kohgiluyeh and Boyer Ahmad Province), at 30°51'–31°12'N and 50°10'–50°40'E. Altitudinally, the area ranges from 1000 m to 3000 m. River Maroun is located in the southern part of Lendeh (Fig. 1). The annual precipitation is

424 mm, the mean annual temperature 24°C and the mean annual minimum and maximum temperatures are 7.7°C and 35.2°C, respectively (Fig. 2). Based on a recent bioclimatic classification, the area belongs to the Mediterranean Pluviseasonal Continental Bioclimate (Djamali & al. 2011).

Data collection and analyses

Data was collected in spring and summer of 2011 and 2012. The plant specimens were identified by consulting *Flora Iranica* (Rechinger 1963–2015), *Flora of Iran* (Assadi & al. 1989–2016), *Flora of Turkey* (Davis 1965–1988) and *Color Flora of Iran* (Ghahreman 1978–2006). The voucher specimens were deposited at the Herbarium of the University of Mazandaran (HUMZ). Data on the distribution of species was extracted mainly from the above-mentioned nomenclature sources. The main concepts of phytochoria were based on Zohary (1973), Takhtajan (1986), and Léonard (1988). The Raunkiaer system of classification (Raunkiaer 1934) was used for determination of life form categories, and the conservation status of plant taxa were determined according to the *Red Data Book of Iran* (Jalili & Jamzad 1999).

Results

Altogether, 282 plant taxa belonging to 198 genera and 65 families were found growing in the different habitats of the study area (Table 1). Of all vascular plants, 44 species (15.6 %) were monocotyledons, and 238 species (83.4 %) were dicotyledons. In the study area, *Asteraceae* (32 taxa), *Fabaceae* (31 taxa), *Lamiaceae* (23 taxa), *Poaceae* (23 taxa), and *Apiaceae* (17 taxa) were the largest plant families in terms of species richness (Fig. 3). The genera with a greater number of species were *Bromus* (7 taxa), *Astragalus* (6 taxa) and *Trifolium* (5 taxa), respectively (Table 1). The dominant life forms were hemicryptophytes (95 taxa, 33.7 %), followed by therophytes (84 taxa, 29.8 %), geophytes (40 taxa, 14.2 %), phanerophytes (38 taxa, 13.5 %), and chamaephytes (28 taxa, 8.9 %) (Fig. 4). From a phytogeographical point of view, Irano-Turanian elements (IT) (121 taxa, 42.9 %) were the dominant chorotype in the study area, of which 32 taxa were endemic to Iran (Fig. 5). According to the *Red Data Book of Iran*, 38 threatened plant taxa were identified in the study area. Among these

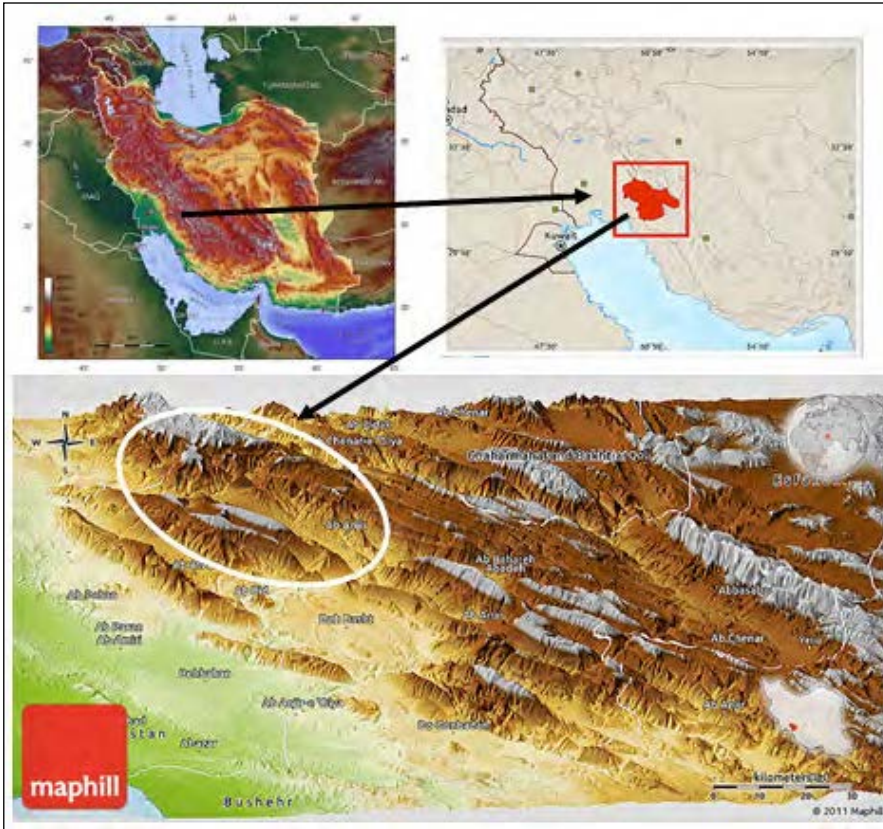


Fig. 1. Location of Mt Kuh-e Siah in Kohgiluyeh and Boyer Ahmad Province, Iran.

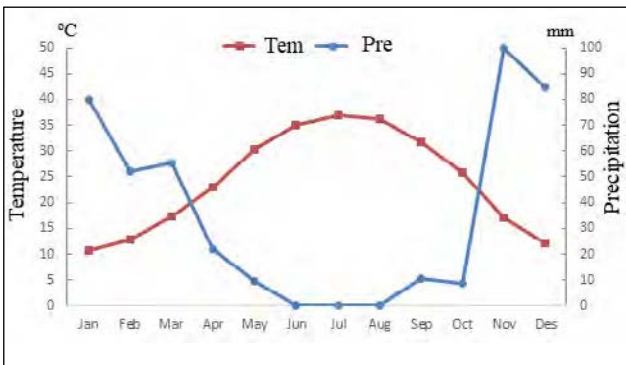


Fig. 2. Climatic curve for the Dehdasht Synoptic Station (2006-2017).

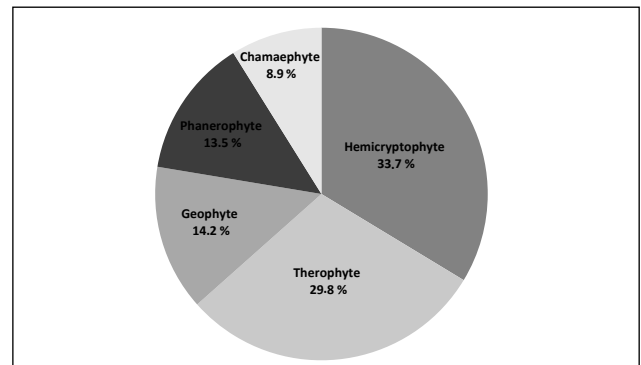


Fig. 4. Plant life form spectrum in the study area.

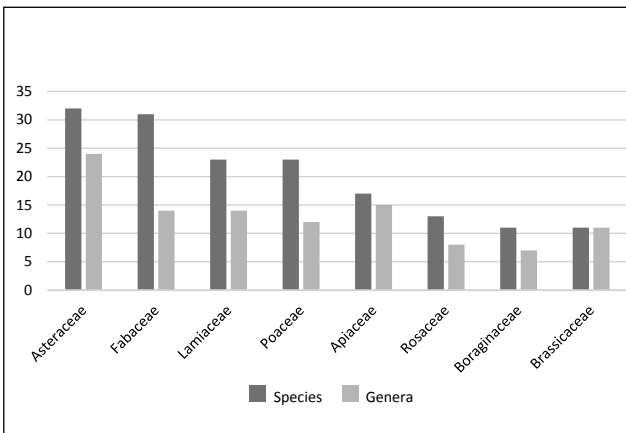


Fig. 3. The species- and genera-richest families.

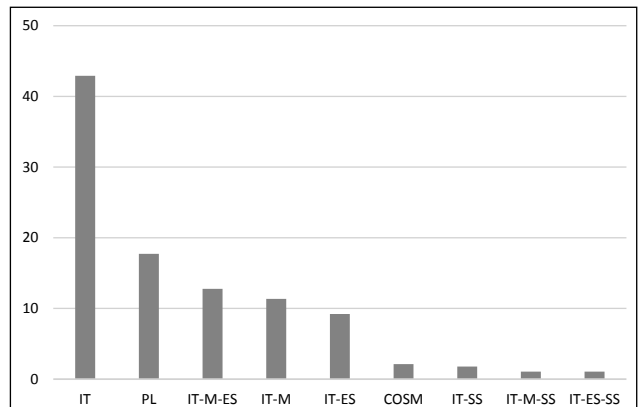


Fig. 5. Percentage of all plant species among chorotypes in the study area.

species, one species (*Allium hirtifolium*) was classified as Endangered (EN), one species (*Arum giganteum*) as Vulnerable (VU), two species (*Cousinia bach-*

tiarica and *Serratula bachtiarica*) were in the Data Deficient (DD) category, and 34 plant taxa were in the Lower Risk (LR) category (Table 1).

Table 1. Checklist of vascular plant species in Mt Kuh-e Siah. Abbreviations: Life form: Ch – chamaephyte, Ge – geophyte, He – hemicryptophyte, Ph – phanerophyte, T – therophyte. Chorotype: COSM – Cosmopolitan, ES – Euro-Siberian, IT – Irano-Turanian, M – Mediterranean, SS – Saharo-Sindian, PL – Pluriregional. Conservation status: DD – Data Deficient, EN – Endangered, LR – Lower Risk, VU – Vulnerable.

Family	Taxa	Life form	Chorotype	Conservation status	Herbarium No.
Amaranthaceae	<i>Amaranthus blitoides</i> S.Watson	Th	PL		3659
	<i>Amaranthus retroflexus</i> L.	Th	PL		3658
	<i>Atriplex tatarica</i> L.	Th	PL		3760
	<i>Chenopodium album</i> subsp. <i>iranicum</i> Aellen	Th	IT		3758
	<i>Chenopodium foliosum</i> Aschers	Th	PL		3759
Amaryllidaceae	<i>Allium ampeloprasum</i> subsp. <i>iranicum</i> Wendelbo	Ge	IT		3653
	<i>Allium hirtifolium</i> Boiss.	Ge	IT (endemic)	EN	3652
	<i>Allium rotundum</i> L.	Ge	IT-ES		3655
	<i>Allium scabriscapum</i> Boiss.	Ge	IT-ES		3656
	<i>Ixiolirion tataricum</i> (Pall.) Herb.	Ge	PL		3660
Anacardiaceae	<i>Pistacia atlantica</i> subsp. <i>kurdica</i> (Zohary) Rech. f.	Ph	IT		3662
	<i>Pistacia khinjuk</i> Stocks	Ph	IT-SS		3663
Apiaceae	<i>Bunium paucifolium</i> DC.	Ge	IT		3670
	<i>Chaerophyllum macropodium</i> Boiss.	He	IT		3672
	<i>Dorema aucheri</i> Boiss.	He	IT (endemic)	LR	3664
	<i>Eryngium billardieri</i> F. Delaroché	He	IT-M-ES		3671
	<i>Ferula haussknechtii</i> Wolff ex Rech.f.	He	IT		3665
	<i>Ferulago angulata</i> (Schlecht.) Boiss.	He	IT	LR	3666
	<i>Grammosciadium scabridum</i> Boiss.	He	IT		3667
	<i>Malabaila porphyrodiscus</i> Stapf & Wettst. ex Stapf.	He	IT (endemic)	LR	3668
	<i>Pimpinella affinis</i> Ledeb.	He	IT-ES		3673
	<i>Prangos ferulacea</i> (L.) Lindl.	He	IT-M-ES		3674
	<i>Prangos uloptera</i> DC.	He	IT		3675
	<i>Scandix iberica</i> M.B.	Th	IT-ES		3678
	<i>Scandix pecten-veneris</i> L.	Th	IT-M-ES		3680
	<i>Smyrniopsis aucheri</i> Boiss.	He	IT		3676
	<i>Smyrniium cordifolium</i> Boiss.	He	IT		3677
<i>Torilis leptophylla</i> (L.) Reichenb.	Th	IT-ES		3679	
<i>Turgenia latifolia</i> (L.) Hoffm.	Th	IT-M		3681	
Araceae	<i>Arum giganteum</i> Ghahr.	Ge	IT	VU	3683
Aristolochiaceae	<i>Aristolochia olivieri</i> Collegno	He	IT (endemic)	LR	3685
Asclepiadaceae	<i>Marsdenia erecta</i> (L.) R. Br.	Ph	IT-M		3686
Asparagaceae	<i>Bellevalia glauca</i> (Lindl.) Kunth	Ge	IT		3849
	<i>Muscari neglectum</i> Guss.	Ge	IT-M-ES		3857
	<i>Muscari tenuiflorum</i> Tausch	Ge	IT-ES		3858
	<i>Ornithogalum cuspidatum</i> Bertol.	Ge	IT-M		-
	<i>Ornithogalum persicum</i> Husskn. ex Bornm.	Ge	IT		3860
Asphodelaceae	<i>Eremurus spectabilis</i> subsp. <i>spectabilis</i> M. B.	Ge	IT-M		3854
Asteraceae	<i>Achillea wilhelmsii</i> C. Koch	He	IT		3709
	<i>Calendula persica</i> C. A. Mey.	Th	IT		3710
	<i>Carduus arabicus</i> subsp. <i>arabicus</i> Jacq. ex Murray	Th	IT-M-ES		3697
	<i>Centaurea bruguierana</i> subsp. <i>belangerana</i> (DC.) Bornm.	Th	IT-SS		3719
	<i>Centaurea intricata</i> subsp. <i>intricata</i> Boiss.	Ch	IT		3689
	<i>Centaurea virgata</i> subsp. <i>squarrosa</i> (Willd.) Gugler	He	IT-ES		3700

Table 1. Continuation.

Family	Taxa	Life form	Chorotype	Conservation status	Herbarium No.
	<i>Cichorium intybus</i> L.	He	PL		3701
	<i>Cirsium bracteosum</i> DC.	He	IT	LR	3702
	<i>Cirsium congestum</i> var. <i>congestum</i> Fisch. & C. A. Mey. ex DC.	He	IT		3703
	<i>Cirsium spectabile</i> DC.	Ge	IT (endemic)	LR	3720
	<i>Conyza canadensis</i> (L.) Cronq.	Th	COSM		3705
	<i>Cousinia bachtiarica</i> Boiss. & Hausskn.	He	IT (endemic)	DD	3690
	<i>Cousinia multiloba</i> DC.	He	IT		3691
	<i>Crepis sancta</i> subsp. <i>iranica</i> Rech. f.	Th	IT-M		3722
	<i>Crupina crupinastrum</i> (Moris) Vis.	Th	IT-ES-M		3714
	<i>Echinops cyanocephalus</i> Boiss. & Hausskn.	He	IT (endemic)		3692
	<i>Echinops ritrodes</i> Bunge	He	IT		3704
	<i>Gundelia tournefortii</i> L.	Ch	IT		3706
	<i>Helichrysum oligocephalum</i> DC.	Ch	IT (endemic)	LR	3687
	<i>Notobasis syriaca</i> (L.) Cass.	Th	IT-M		3716
	<i>Outreya carduiiformis</i> Jaub. & Spach	He	IT		3694
	<i>Rhagadiolus stellatus</i> (L.) Gaertn.	Th	IT-M		3713
	<i>Scariola orientalis</i> subsp. <i>orientalis</i> (Boiss.) Sojak	Ch	IT		3707
	<i>Scorzonera luristanica</i> Rech.f.	He	IT		3688
	<i>Serratula bachtiarica</i> Boiss. & Hausskn.	He	IT (endemic)	DD	3695
	<i>Silybum marianum</i> (L.) Gaertn.	He	IT-M-ES		3711
	<i>Sonchus asper</i> subsp. <i>glaucescens</i> (Jordan) Ball	He	IT-M		3715
	<i>Sonchus oleraceus</i> L.	He	COSM		3712
	<i>Tanacetum polycephalum</i> subsp. <i>polycephalum</i> Schultz	He	IT		3721
	<i>Tragopogon bupthalmoides</i> var. <i>bupthalmoides</i> (DC.) Boiss.	He	IT		3708
	<i>Tragopogon collinus</i> DC.	He	IT		3698
	<i>Urospermum picroides</i> (L.) Desf.	Th	IT-M-ES		3717
Berberidaceae	<i>Bongardia chrysozonum</i> (L.) Spach	Ge	IT-M		3914
Boraginaceae	<i>Anchusa italica</i> var. <i>italica</i> Retz.	He	IT-M-ES		3732
	<i>Anchusa strigosa</i> subsp. <i>strigosa</i> Labill.	He	IT-M		3734
	<i>Arnebia euchroma</i> (Royle) I. M. Johnst.	Ge	IT		3724
	<i>Asperugo procumbens</i> L.	Th	PL		3733
	<i>Echium italicum</i> var. <i>italicum</i> L.	He	IT-ES		3727
	<i>Nonnea persica</i> Boiss.	He	IT		3726
	<i>Onosma microcarpum</i> DC.	He	IT		3728
	<i>Onosma nervosum</i> H. Riedl	He	IT		3725
	<i>Onosma rostellatum</i> Lehm.	He	IT		3723
	<i>Onosma sericeum</i> Willd.	He	IT		3729
	<i>Solenanthus circinnatus</i> Ledeb.	He	IT		3730
Brassicaceae	<i>Capsella bursa-pastoris</i> (L.) Medicus	Th	PL		3739
	<i>Cardaria draba</i> subsp. <i>chalepensis</i> (L.) O. E. Schulz	He	PL		3744
	<i>Descurainia sophia</i> (L.) Webb & Berth.	He	IT-M-ES		3745
	<i>Erucaria hispanica</i> (L.) Druce	He	IT-M		3747
	<i>Fibigia macrocarpa</i> var. <i>microcarpa</i> Boiss.	Ch	IT (endemic)		3735
	<i>Hirschfeldia incana</i> (L.) Lagrèze-Fossat	He	IT-ES		3740
	<i>Isatis raphanifolia</i> Boiss.	Th	IT (endemic)	LR	3737
	<i>Lepidium latifolium</i> L.	He	IT-M-ES		3746
	<i>Neslia apiculata</i> Fish.	Th	IT-M-ES		3741
	<i>Peltaria angustifolia</i> DC.	Th	IT		3738
	<i>Sisymbrium septulatum</i> DC.	Th	IT		3743
Campanulaceae	<i>Campanula cecilii</i> Rech. f. & Schiman-Czeika	Th	IT		3748

Table 1. Continuation.

Family	Taxa	Life form	Chorotype	Conservation status	Herbarium No.
	<i>Campanula erinus</i> L.	Th	IT-M		3749
Capparidaceae	<i>Capparis spinosa</i> var. <i>spinosa</i> L.	Ph	IT-ES-SS		3750
Caprifoliaceae	<i>Lonicera nummulariifolia</i> Jaub. & Spach	Ph	IT-M		3751
	<i>Morina persica</i> L.	He	IT-M-ES		3875
Caryophyllaceae	<i>Dianthus orientalis</i> subsp. <i>orientalis</i> Adams	Ch	IT		3754
	<i>Gypsophila pilosa</i> Huds.	Th	IT-M		3756
	<i>Silene chlorifolia</i> Sm.	He	IT		3755
	<i>Silene conoidea</i> L.	Th	IT-M		3757
	<i>Vaccaria grandiflora</i> (Fisch. ex DC.) Jaub. & Spach	Th	IT		3753
Cistaceae	<i>Helianthemum salicifolium</i> (L.) Miller	Th	IT-M-ES		3761
Colchicaceae	<i>Colchicum kotschyi</i> Boiss.	Ge	IT		3763
	<i>Colchicum persicum</i> Baker	Ge	IT-SS		3764
Convolvulaceae	<i>Convolvulus arvensis</i> L.	He	PL		3766
	<i>Convolvulus stachydifolius</i> Choisy	He	IT-ES		3767
Crassulaceae	<i>Rosularia elymaitica</i> (Boiss. & Hausskn.) Berger	He	IT (endemic)	LR	3768
Cuscutaceae	<i>Cuscuta campestris</i> Yunck.	Th	COSM		3769
Cyperaceae	<i>Cyperus rotundus</i> L.	Ge	PL		3771
Dipsaceae	<i>Pterocephalus canus</i> Coult. ex DC.	Ch	IT		3772
Elaeagnaceae	<i>Elaeagnus angustifolia</i> L.	Ph	IT-ES		3773
Euphorbiaceae	<i>Chrozophora tinctoria</i> (L.) Juss.	He	IT-ES		3776
	<i>Euphorbia condylocarpa</i> M. B.	He	IT		3777
	<i>Euphorbia helioscopia</i> L.	He	PL		3778
	<i>Euphorbia macroclada</i> Boiss.	He	IT		3774
	<i>Euphorbia macrostegia</i> Boiss.	He	IT (endemic)	LR	3775
Fabaceae	<i>Alhagi persarum</i> Boiss. & Buhse	He	IT		3789
	<i>Astragalus brachycalyx</i> Fisch.	Ch	IT	LR	3808
	<i>Astragalus crispocarpus</i> Nábelek	Th	IT	LR	3779
	<i>Astragalus murinus</i> subsp. <i>murinu</i> Boiss.	Ch	IT (endemic)	LR	3780
	<i>Astragalus ovinus</i> Boiss.	Ch	IT		3809
	<i>Astragalus susianus</i> subsp. <i>susianus</i> Boiss.	Ch	IT (endemic)	LR	3781
	<i>Astragalus siliquosus</i> subsp. <i>siliquosus</i> Boiss.	Ch	IT		3782
	<i>Cicer arietinum</i> L.	Th	COSM		3805
	<i>Coronilla varia</i> var. <i>varia</i> L.	He	IT-M-ES		3790
	<i>Glycyrrhiza glabra</i> var. <i>glabra</i> L.	Ge	IT-M-ES	LR	3784
	<i>Hymenocarpus circinnatus</i> subsp. <i>circinnatus</i> (L.) Savi	Th	IT-M		3806
	<i>Lens culinaris</i> Medicus	Th	IT		3788
	<i>Lotus corniculatus</i> L.	He	PL		3795
	<i>Medicago orbicularis</i> (L.) Bartalini	Th	IT-M-ES	LR	3793
	<i>Medicago radiata</i> L.	Th	IT-M		3800
	<i>Medicago rigidula</i> (L.) All.	Th	PL	LR	3801
	<i>Medicago sativa</i> L.	He	PL		3791
	<i>Melilotus albus</i> Medicus	He	PL		3785
	<i>Melilotus officinalis</i> (L.) Pall.	He	PL		3786
	<i>Onobrychis caput -galli</i> (L.) Lam.	Th	IT-M		3794
	<i>Onobrychis lunata</i> Boiss.	He	IT (endemic)	LR	3810
	<i>Trifolium pratense</i> L.	He	PL		3796
	<i>Trifolium resupinatum</i> L.	Th	PL		3797
	<i>Trifolium scabrum</i> L.	Th	IT-M-ES		3802
	<i>Trifolium stellatum</i> L.	Th	PL		3798
	<i>Trifolium tomentosum</i> L.	Th	IT-M		3803
	<i>Trigonella uncata</i> Boiss & Noé.	Th	IT-M-ES		3783

Table 1. Continuation.

Family	Taxa	Life form	Chorotype	Conservation status	Herbarium No.
	<i>Vicia peregrina</i> L.	Th	IT-M-ES		3799
	<i>Vicia sativa</i> var. <i>sativa</i> L.	Th	PL		3811
	<i>Vicia variabilis</i> Freyn & Sint.	He	IT-ES		3787
	<i>Vicia villosa</i> Roth.	He	IT-ES		3792
Fagaceae	<i>Quercus brantii</i> var. <i>persica</i> Lindl.	Ph	IT (endemic)		3812
Gentianaceae	<i>Gentiana olivieri</i> Griseb.	He	IT-ES-SS		3814
Geraniaceae	<i>Biebersteinia multifida</i> DC.	Ge	IT		3817
	<i>Erodium cicutarium</i> (L.) LHér. ex Aiton	Th	PL		3819
	<i>Erodium gruinum</i> (L.) LHér. ex Aiton	Th	IT-M		3820
	<i>Erodium oxycorrhynchum</i> subsp. <i>oxycorrhynchum</i> M. B.	Th	IT-ES		3818
	<i>Geranium lucidum</i> L.	Th	IT-M-ES		3815
	<i>Geranium tuberosum</i> L.	Ge	IT-M-ES		3816
Hypericaceae	<i>Hypericum scabrum</i> L.	He	IT		3821
Iridaceae	<i>Gladiolus segetum</i> Ker Gawl.	Ge	IT-M-ES		3823
Juncaceae	<i>Juncus inflexus</i> L.	Ge	PL		3824
Lamiaceae	<i>Ajuga austro-iranica</i> Rech.f.	He	IT		3826
	<i>Ballota aucheri</i> Boiss.	Ch	IT		3827
	<i>Eremostachys laevigata</i> Bunge	He	IT		3828
	<i>Eremostachys macrophylla</i> Montbr. & Auch.	He	IT		3840
	<i>Marrubium cuneatum</i> Russell	Ge	IT		3834
	<i>Mentha longifolia</i> var. <i>asiatica</i> (Boriss.) Rech. f.	Ge	IT		3835
	<i>Nepeta kotschyi</i> var. <i>persica</i> (Boiss.) Jamzad	He	IT	LR	3845
	<i>Nepeta macrosiphon</i> Boiss.	Ch	IT		3829
	<i>Phlomis elliptica</i> Benth.	Ph	IT (endemic)	LR	3825
	<i>Phlomis olivieri</i> Benth.	He	IT		3836
	<i>Phlomis persica</i> Boiss.	He	IT (endemic)	LR	3830
	<i>Salvia persepolitana</i> Boiss.	He	IT (endemic)	LR	3847
	<i>Salvia sclarea</i> L.	He	PL		3838
	<i>Salvia syriaca</i> L.	Ge	IT		3841
	<i>Salvia virgata</i> Jacq.	He	IT-ES		3839
	<i>Scutellaria ariana</i> Hedge	Ch	IT		3846
	<i>Stachys lavandulifolia</i> Vahl	Ch	IT		3832
	<i>Stachys pilifera</i> Benth.	Ch	IT (endemic)	LR	3848
	<i>Teucrium orientale</i> subsp. <i>orientale</i> L.	He	IT		3833
	<i>Teucrium polium</i> var. <i>tonsum</i> Stapf	Ch	IT		3844
	<i>Thymus daënenensis</i> subsp. <i>daënenensis</i> Čelak.	Ch	IT (endemic)	LR	3831
	<i>Vitex pseudo-negundo</i> (Hauskn.) Hand. -Mzt.	Ph	IT-SS		3975
	<i>Ziziphora tenuior</i> L.	Th	IT-ES		3843
Liliaceae	<i>Fritillaria imperialis</i> L.	Ge	IT		3851
	<i>Gagea fistulosa</i> Ker-Gawl.	Ge	IT-M-ES		3856
	<i>Gagea tenuifolia</i> (Boiss.) Fomin	Ge	PL		3861
	<i>Tulipa montana</i> var. <i>montana</i> Lindl.	Ge	IT		3855
Loranthaceae	<i>Loranthus grewinkii</i> Boiss. & Buhse	Ph	IT (endemic)		3863
Lythraceae	<i>Punica granatum</i> L.	Ph	IT-M-ES		3923
Malvaceae	<i>Alcea kurdica</i> var. <i>kurdica</i> (Schlecht.) Alef.	He	IT		3866
	<i>Malva parviflora</i> L.	Th	IT-M-SS		3867
Moraceae	<i>Ficus carica</i> subsp. <i>rupestris</i> (Hauskn. ex Boiss.) Browicz	Ph	IT-M		-
	<i>Ficus carica</i> subsp. <i>carica</i> L.	Ph	IT-M-ES		3872
	<i>Morus alba</i> L.	Ph	IT		3874
Myrtaceae	<i>Myrtus communis</i> L.	Ph	IT-M-SS		3876
Oleaceae	<i>Fraxinus rotundifolia</i> subsp. <i>rotundifolia</i> Miller	Ph	IT-M-ES		3877

Table 1. Continuation.

Family	Taxa	Life form	Chorotype	Conservation status	Herbarium No.
Orobanchaceae	<i>Orobanche hirtiflora</i> (Reut.) Tzvel.	Th	IT-ES		3878
	<i>Orobanche ramosa</i> L.	Th	PL		3879
Papaveraceae	<i>Papaver dubium</i> L.	Th	PL		3880
	<i>Roemeria refracta</i> DC.	Th	IT		3881
Plantaginaceae	<i>Linaria fastigiata</i> Chav.	He	IT-M		3961
	<i>Plantago lagopus</i> L.	Th	IT-M		3885
	<i>Plantago lanceolata</i> L.	He	PL		3883
	<i>Plantago psyllium</i> L.	Th	IT-M		3884
	<i>Veronica anagallis-aquatica</i> subsp. <i>oxycarpa</i> (Boiss.) A. Jelen.	Ge	PL		3962
	<i>Veronica arvensis</i> L.	Th	PL		3963
Platanaceae	<i>Platanus orientalis</i> L.	Ph	IT-ES		3882
Plumbaginaceae	<i>Acantholimon bromifolium</i> var. <i>bromifolium</i> Boiss.	Ch	IT		3886
	<i>Acantholimon erinaceum</i> (Jaub. & Spach) Lincz.	Ch	IT		3887
Poaceae	<i>Agropyrum trichophorum</i> (Link) Richter	He	IT-M-ES		3903
	<i>Avena fatua</i> var. <i>fatua</i> L.	Th	PL		3908
	<i>Avena wiestii</i> Steud.	Th	PL		3900
	<i>Bromus danthoniae</i> var. <i>danthoniae</i> Tbin.	Th	PL		3892
	<i>Bromus fasciculatus</i> var. <i>alexandrinus</i> Thell.	Th	IT-M	LR	3909
	<i>Bromus scoparius</i> var. <i>scoparius</i> L.	Th	IT-M		3905
	<i>Bromus sericeus</i> Drobov	Th	IT		3888
	<i>Bromus sterilis</i> L.	Th	IT-M-ES		3893
	<i>Bromus tectorum</i> var. <i>tectorum</i> L.	Th	IT-M-ES		3894
	<i>Bromus tomentellus</i> Boiss.	He	IT-ES		3891
	<i>Cynodon dactylon</i> (L.) Pers.	He	PL		3901
	<i>Heterantherium piliferum</i> (Banks & Soland.) Hochst.	Th	IT-M		3912
	<i>Hordeum bulbosum</i> L.	Ge	IT-M-ES		3904
	<i>Hordeum glaucum</i> Steud.	Th	PL		3896
	<i>Hordeum marinum</i> var. <i>pubescens</i> (Guss.) Nevski.	Th	IT-M		3913
	<i>Hordeum spontaneum</i> C. Koch	Th	IT-M		3906
	<i>Lolium perenne</i> L.	He	PL		3890
	<i>Lolium persicum</i> Boiss. & Hohen. ex Boiss.	Th	IT-M-ES		3897
	<i>Lophochloa phleoides</i> (Vill.) Reichenb.	Th	IT-ES-SS		3902
	<i>Phragmites australis</i> var. <i>australis</i> (Cav.) Trin. ex Steud.	Ge	PL		3889
<i>Poa bulbosa</i> L.	Ge	IT-M-ES		3910	
<i>Polypogon monspeliensis</i> (L.) Desf.	Th	PL		3907	
<i>Setaria viridis</i> (L.) P. Beauv.	Th	PL		3899	
Polygonaceae	<i>Polygonum patulum</i> M. B.	Th	IT-ES		3917
	<i>Rheum ribes</i> L.	Ge	IT		3919
	<i>Rumex dentatus</i> subsp. <i>halácsyi</i> (Rech.) Rech.f.	Th	IT-ES		3918
Portulaccaceae	<i>Portulaca oleracea</i> L.	Th	COSM		3920
Primulaceae	<i>Anagallis arvensis</i> L.	Th	PL		3922
	<i>Dionysia bryoides</i> Boiss.	Ch	IT (endemic)	LR	3921
Rafflesiaceae	<i>Pilostyles haussknechtii</i> Boiss.	Th	IT		3924
Ranunculaceae	<i>Clematis ispanica</i> Boiss.	Ch	IT		3928
	<i>Delphinium cyphoplectrum</i> Boiss.	He	IT-SS		3933
	<i>Ficaria kochii</i> (Ledeb.) Iranshahr & Rech. f.	He	IT-ES		3929
	<i>Ranunculus arvensis</i> L.	Th	PL		3931
	<i>Ranunculus asiaticus</i> L.	He	IT-M		3930
	<i>Ranunculus elymiaticus</i> Boiss. & Hausskn.	He	IT (endemic)	LR	3925
<i>Ranunculus kotschyi</i> Boiss.	He	IT (endemic)	LR	3926	
Rhamnaceae	<i>Rhamnus pallasii</i> subsp. <i>iranica</i> (Hausskn. ex Bornm.) Browicz & J. Zielinski	Ph	IT (endemic)	LR	3934

Table 1. Continuation.

Family	Taxa	Life form	Chorotype	Conservation status	Herbarium No.
	<i>Ziziphus spina-christi</i> (L.) Willd.	Ph	IT-M-SS		3935
Rosaceae	<i>Amygdalus haussknechtii</i> (C. K. Schneider) Bornm.	Ph	IT (endemic)	LR	3937
	<i>Amygdalus scoparia</i> Spach	Ph	IT		3948
	<i>Cerasus mahaleb</i> (L.) Miller	Ph	PL		3944
	<i>Cerasus microcarpa</i> subsp. <i>tortuosa</i> (Boiss. & Hausskn.) Browicz	Ph	IT-M		3938
	<i>Cotoneaster luristanicus</i> Klotz	Ph	IT		3939
	<i>Crataegus atosanguinea</i> A. Pojark.	Ph	IT		3943
	<i>Crataegus pontica</i> C. Koch	Ph	IT		3945
	<i>Crataegus songarica</i> C. Koch.	Ph	PL		3946
	<i>Sanguisorba minor</i> Scop.	He	PL		3949
	<i>Pyrus glabra</i> Boiss.	Ph	IT (endemic)	LR	3940
	<i>Rosa canina</i> L.	Ph	IT-M-ES		3947
	<i>Rosa elymaitica</i> Boiss. & Hausskn.	Ph	IT		3941
	<i>Rubus anatolicus</i> (Focke) Focke ex Hausskn.	Ph	PL		3942
Rubiaceae	<i>Asperula glomerata</i> subsp. <i>eriantha</i> (Hausskn. ex Bornm.) Ehrend.	He	IT		3951
	<i>Callipeltis cucullaria</i> (L.) DC.	Th	PL		3956
	<i>Crucianella gilanic</i> subsp. <i>gilanic</i> Trin.	He	IT-ES		3953
	<i>Galium aparine</i> L.	He	PL		3955
	<i>Galium verum</i> subsp. <i>verum</i> L.	Ge	PL		3954
	<i>Rubia albicaulis</i> Boiss.	Ph	IT (endemic)	LR	3952
Salicaceae	<i>Populus alba</i> L.	Ph	IT-M-ES		3959
	<i>Salix excelsa</i> S. G. Gmelin	Ph	PL		3958
Santhalaceae	<i>Thesium kotschyanum</i> Boiss.	Ge	IT		3960
Sapindaceae	<i>Acer monspessulanum</i> subsp. <i>persicum</i> (Pojark.) Rech.f.	Ph	IT (endemic)	LR	3651
Scrophulariaceae	<i>Scrophularia striata</i> Boiss.	Ch	IT		3964
	<i>Verbascum sinuatum</i> var. <i>sinuatum</i> L.	He	IT-M		3965
Solanaceae	<i>Hyoscyamus senecionis</i> Willd.	Ge	IT		3968
	<i>Hyoscyamus tenuicaulis</i> Schönbe-Temesy	Ch	IT (endemic)	LR	3967
	<i>Physalis divaricata</i> D. Don.	Th	PL		3969
	<i>Solanum nigrum</i> L.	Th	COSM		3966
Tamaricaceae	<i>Tamarix ramosissima</i> Ledeb.	Ph	IT-ES		3970
Thymeleaceae	<i>Daphne mucronata</i> Royle	Ph	IT		3971
Ulmaceae	<i>Celtis caucasica</i> Willd.	Ph	IT-ES		3972
Urticaceae	<i>Parietaria judaica</i> L.	He	IT-M-ES		3973
Valerianaceae	<i>Valeriana sisymbriifolia</i> Vahl	Ge	IT		3974

Discussion

Within the Irano-Anatolian Biodiversity Hotspot (Groombridge & al. 2002), Zagros Mts are considered an important center of biodiversity and endemism for a large number of taxonomic groups (e.g. Noroozi & al. 2018). Kuh-e Siah is one of the most attractive and least accessible points of the Zagros Mountain Range. Despite its relatively small area, Mt Kuh-e Siah offers a great plant species richness. The 32 species endemic to Iran occurring in this mountain indicate the conservational importance of the oak woodland. Similarly to other parts of the Zagros

Oak Forests, that mountain is classified among the world forest steppe biomes (Erdős & al. 2018).

In the study area, more than 13 % of the flora was constituted of trees and shrubs, the most important of which were: *Pistachia khinjuk*, *P. atlantica*, *Amygdalus haussknechtii*, *Quercus brantii*, *Acer monspessulanum*, and *Lonicera numulariifolia*. *Astragalus* was regarded as one of the largest genera in this study, which was consistent with similar studies in other mountain divides of the Zagros Range (e.g. Zarifian 2012). One reason for the high diversity of that genus in Iran was its better adaptation to the mountainous climate (Darvishnia & al. 2012).

Similarly to other mountainous areas with cold and harsh climate (Archibald 1995), Kuh-e Siah presented the greatest number of hemicryptophytes in terms of proportion of the life forms (Jafari Kookhdan 2002; Yousofi & al. 2011; Naghipour Borj & al. 2014; Jafari, & Zarifian 2016). Besides hemicryptophytes, the proportion of therophytes was relatively high, which testified to aridity in some parts of these steppe forests. These plants dominated particularly in early spring, at higher precipitation, especially in the understory of the oak woodlands. The results were consistent with the findings of Yousofi & al. (2011). On the other hand, the high percentage of Irano-Turanian elements (121 taxa, 42.9%) indicated that, similarly to other areas of the Zagros Range, that area belonged to the Irano-Turanian Phytogeographical Region within the Kurdo-Zagrosian Phytogeographical subprovince (see Takhtajan 1986; Manafzadeh et al. 2017).

Due to closeness of the study area to the Saharo-Sindian and Saharo-Arabian phytogeographical regions, it was suitable for occurrence of a great number of bi/tri-regional elements (Léonard 1989; Asri & Mehrnia 2002; Sokhanvar & al. 2013). The topographical complexity of the northern "Sardsir" areas and high-altitude mountains such as Dena (3950 m a.s.l.), Dameh (2921 m a.s.l.) and Nil (3415 m a.s.l.) was greater than in the low-altitude mountains in the southern parts with warmer climate, such as Kuh-e Sefid (1890 m). The mountains in the cold regions of the province had an average annual precipitation of 700 mm, while the mountains in the warmer regions of the Province had an average annual precipitation of 300 mm (Zarifian 2014).

Quercus branti, the most important and dominant tree species, specifically in Mt Kuh-e Siah and generally in the Zagros ecoregion, formed the relatively open woodland vegetation up to 2500 m a.s.l., with high cover of annual grasses in the understory. That important tree was accompanied with other trees and shrubs, namely: *Pistachia atlantica*, *Crataegus pontica*, *Fraxinus angustifolia*, *Cotoneaster luristanica*, *Amygdalus haussknechtii*, *Lonicera numulariifolia*, *Acer monspessulanum*, and *Cerasus microcarpa*. Above the timberline, similarly to other mountainous parts of Iran (e.g. Alborz range, Akhaneh & al. 2013; Mahdavi & al. 2013), a cushion-like type of vegetation predominated in the mountains due to its better adaptation to low temperatures and strong winds.

Mt Kuh-e Siah in the Zagros forest steppe biome was inhabited by several endemic and rare plant species, indicating the important biodiversity of the study area in SW Iran. Therefore, the authors strongly recommend some conservation efforts for this area under the Department of Environment of Iran.

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