IRANIAN JOURNAL OF BOTANY 31(1), 2025
DOI: https://doi.org/10.22092/ijb.2025.369071.1517

ALPINE AND SUBALPINE FLORISTIC SURVEY OF KEYNO MOUNTAIN, SOUTHWEST IRAN (KHUZESTAN PROVINCE)

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Abstract
Keyno Mountain is located at an altitude of 1,500 to 3,747 meters a.s.l. in the Zagros Mountains, on the border between Khuzestan and Chaharmahal and Bakhtiari provinces. To implement a research project, "Floristic study of the Keyno Mountain", plant species were collected at different scheduled intervals. The main objectives of this study are to provide an annotated checklist of the plants, their life forms, chorotypes, and plant endemism in Keyno Mountain. A total of 151 species of vascular plants belonging to 110 genera and 38 plant families are found in alpine and subalpine zones. The richest families are: Asteraceae (18 species), Lamiaceae (16), Caryophyllaceae and Poaceae (each with 13), Fabaceae and Apiaceae (each with 11). In terms of geographical distribution, 64% of the identified species belong to the Irano-Turanian region. The most abundant vegetation form in the Keyno Mountain area is the Hemicryptophytes (53 species). In the Keyno region, 26 endemic species were identified. The genera *Astragalus* (10 species), *Cousinia* (5 species), and *Stachys* (4 species) are the richest on Keyno Mountain. Most endemic species including *Astragalus murinus* Boiss., *Cousinia bazoftensis* Attar., *Myopordon aucheri* Boiss., *Cyclotrichum depauperatum* (Bunge.) Manden. & Schehg, *Azilia eryngioides* (Pau) Hedge & Lamond in the Zagros region, including those in the Keyno Mountain, are critically endangered. These plants require strong conservation and management protection because fragile ecosystems are often small, restricted, and isolated.

Keywords: Biogeography; Endemic; Flora; Hemicryptophyte; Irano-Turanian; Zagros.

Citation: Dinarvand, M., Amini Rad, M. & Asri, Y. 2025: Alpine and subalpine floristic survey of Keyno Mountain, southwest Iran (Khuzestan province). Iran. J. Bot. 31 (1): 21-36. https://doi.org/10.22092/ijb.2025.369071.1517

Article history
Received: 06 April 2025
Revised: 17 May 2025
Accepted: 09 June 2025
Published: 30 June 2025

بررسی فلورستیک نواحی آلپی و نیمه آلپی کوه کینو در جنوب غرب ایران (استان خوزستان)

مهری دینارووند: دانشیار پژوهش، بخش تحقیقات جنگلها و مراتع، مرکز تحقیقات و آموزش کشاورزی ومنابع طبیعی استان خوزستان، سازمان تحقیقات، آموزش و ترویج کشاورزی، اهواز، ایران.

محمد امینی راد: دانشیار پژوهش، مؤسسه تحقیقات جنگلها و مراتع کشور، سازمان تحقیقات، آموزش و ترویج کشاورزی، تهران، ایران.

یونس عصری: دانشیار پژوهش، مؤسسه تحقیقات جنگلها و مراتع کشور، سازمان تحقیقات، آموزش و ترویج کشاورزی، تهران، ایران.

چکیده: کوه کینو با ارتفاع ۱۵۰۰ تا ۳۷۴۷ متر از سطح دریا در ارتفاعات زاگرس و بین استان‌های خوزستان و چهار محال بختیاری واقع است. در راستای اجرای پروژه تحقیقاتی «مطالعه فلورستیک کوه کینو» گونه‌های گیاهی طبق برنامه در فواصل زمانی مختلف جمع‌آوری شد. هدف از این پروژه تهیه لیستی کامل از گونه‌های گیاهی، شکل زیستی، پراکنش جغرافیایی و گونه‌های انحصاری در کوه کینو بود. در منطقه مورد مطالعه، تعداد ۱۵۱ گونه گیاهی متعلق ۱۱۰ جنس و ۳۸ تیره در مناطق آلپی، نیمه آلپی جمع آوری و شناسایی شد. بزرگترین تیره‌های گیاهی از نظر تعداد گونه تیره مینا (Asteraceae) با ۱۸ گونه، تیره نعنا (Lamiaceae) با ۱۶ گونه، تیره میخک (Caryophyllaceae) و گندمیان (Poaceae) هر کدام با ۱۳ گونه و تیره‌های باقلائیان (Fabaceae) و چتریان (Apiaceae) هر کدام با ۱۱ گونه هستند. از نظر پراکنش جغرافیایی ۶۴ درصد گونه‌های شناسایی شده متعلق به ناحیه ایرانی‌تورانی هستند. بیشترین شکل زیستی در ارتفاعات کینو متعلق به همی‌کریپتوفیت‌ها با ۵۳ گونه می‌باشد. در منطقه کینو ۲۶ گونه انحصاری شناسایی شد. جنس‌های *Astragalus* با ۱۰ گونه، *Cousinia* با ۵ گونه و *Stachys* با ۴ گونه دارای بیشترین گونه گیاهی ارتفاعات کینو هستند. بعضی از گونه‌های انحصاری مانند *Astragalus murinus* Boiss., *Cousinia bazoftensis* Attar., *Myopordon aucheri* Boiss., *Cyclotrichum depauperatum* (Bunge.) Manden. & Schehg, *Azilia eryngioides* (Pau) Hedge & Lamond در منطقه زاگرسی که ارتفاعات کینو نیز شامل آن می‌شود، به‌عنوان گونه‌های در بحران انقراض معرفی شده‌اند. این گونه‌ها به شدت نیاز به حفاظت و مدیریت دارند زیرا در اکوسیستم‌های شکننده مستقر بوده و اغلب به‌صورت مجزا و در جمعیت‌هایی کوچک دیده می‌شوند.

INTRODUCTION

Khuzestan province covers an area of 64236 square kilometers in the southwest of Iran. The area belongs to two phytogeographical regions, Irano-Turanian (IT) in the north and Sahara-Sindian (SS) (Léonard, 1988-1989; Dinarvand 2003), Sahara-Arabian (Zohary 1973) or Sudano-Zambezian (Takhtajan 1986) in the south. Based on topography it is divided into plain and Zagros regions. The plain region includes steppe vegetation, wetland species, hygrophyte plants, terrestrial halophyte and psamophytic plants, and highlands covered with Oak woodlands and pastures (Dinarvand & Sharifi, 2009; Dinarvand & al., 2018b). There are 15 types of wetlands according to Ramsar wetland classification and 13 types of terrestrial habitats based on geographic position, topography, and main vegetation (Dinarvand & Sharifi, 2009). According to the Global Bioclimatic Classification System of Rivas Martinez, this province has “Tropical desertic” and “Tropical xeric” in the south and “Mediterranean desertic continental” in the north (Djamali & al., 2012). More recently, there have been floristic collections made by local researchers from Khuzestan province (Akhani & Samadi, 2015; Mozaffarian 1999, Salehi & al., 2002; Dinarvand & Jamzad, 2016; Dinarvand & al., 2018a), resulting in the description of several new species and new records. A regional herbarium was established with approximately 10 thousand specimens. Although many species have been collected by Iranian and foreign researchers from various regions of the country, numerous pristine and untouched areas, particularly mountainous areas, with no information about their vegetation. Also, due to the lack of easy access (difficult roads and long mountain hikes) to high mountains, the plant diversity of these areas has not been well studied or has been scattered and transient. Generally, the alpine zone is defined as the altitude range above the tree line and below the naval zone (permanent snow areas) (Körner 2003). The majority of high mountains in Iran are concentrated in the Alborz and Zagros Mountains, respectively. Due to their geographical location, the altitudinal range of the alpine flora varies within these ranges. Noroozi & al. (2007) describe the alpine zones in the Alborz range as ranging from 3000 to 4000 m, with the naval zone above 4000 m. In this research, the flora of Keyno was collected and studied from the Zagros Mountains located in Khuzestan province at an altitude of 3747 meters above sea level. This mountain is the highest peak in Khuzestan province and is known as the Roof of Khuzestan. To implement a research project, "Floristic study of the Keyno Mountain", plant species were collected at different scheduled intervals. The main objectives of this study are to provide an annotated checklist of the plants and their life forms, chorotypes, and plant endemism in the Keyno Mountain, and introduce species of alpine and subalpine areas in Khuzestan province.

MATERIAL AND METHODS

Floristic survey

Field surveys were conducted over three years (2022-2024), and vascular plant specimens were collected from various altitude ranges, slopes, and cliffs. The collection routes were: Andika, Shimbar protected area road to Borhan Vali village and towards the summit line, and the second route, Andika to Shahrekord, Bazoft region, Lebad Village, next to the Dakl (Fig. 1). Collected plants were dried and labeled precisely for the Khuzestan Agricultural and Natural Resources Research and Education Center herbarium. Plant specimens were identified using relevant floras, mainly Flora Iranica (Rechinger 1963-2015), Flora of Iran (Assadi & al. 1988 &2023), Flora of Khuzestan province (Dinarvand, 2021), Flora of Chaharmahal and Bakhtiari (Mozaffarian, 2017), Flora of Iraq (Townsend & Guest 1974-1985), Flora of Turkey and the East Aegean Islands (Davis & al. 1967-1982), Flora Palestina (Zohary 1966-1986), and Trees and Shrubs of Iran (Mozaffarian 2005). The chorotype of each taxon was determined according to the distribution data extracted from the above-mentioned flora and papers. The terminology and delimitation of the main phytogeographical units (IT, M, ES, and SS) were based on classical works, particularly Zohary (1973) and "*Flora of Iran*" (Assadi & al. 1988-2023). Life forms of the plants were determined according to Raunkiaer (1934).

Study area

The Keyno Mount is located at an altitude of 1500-3747 meters above sea level in the Zagros Mountains and on the border of Khuzestan and Chaharmahal and Bakhtiari provinces. Keyno is the summer resort of all the pastoral nomads of its neighboring provinces and is covered with snow most of the year. Due to its special location, The Keyno Mount strengthens the friendship and camaraderie of the Lor-speaking pastoral nomads in Bazoft of Chaharmahal and Bakhtiari, Azna of Lorestan province, and Andika and Lali of Khuzestan province. It leads to the village of Shimbar from the southwest and to the Lebd region from the northeast. Its geographical location overlooks the Ab Bakhtiari and Ab Zalaki rivers and Lorestan province from the north, the Shimbar plain and parts of Khuzestan from the south, the Tembi mountain lake and parts of the Abbid river from the northwest and west, and the Lebad Valley, Bazoft River, Taraz Pass, and Chaharmahal and Bakhtiari Road to Khuzestan from the east. (Fig.1) The coordinates of the peak are: 49.536932, 32.581388.

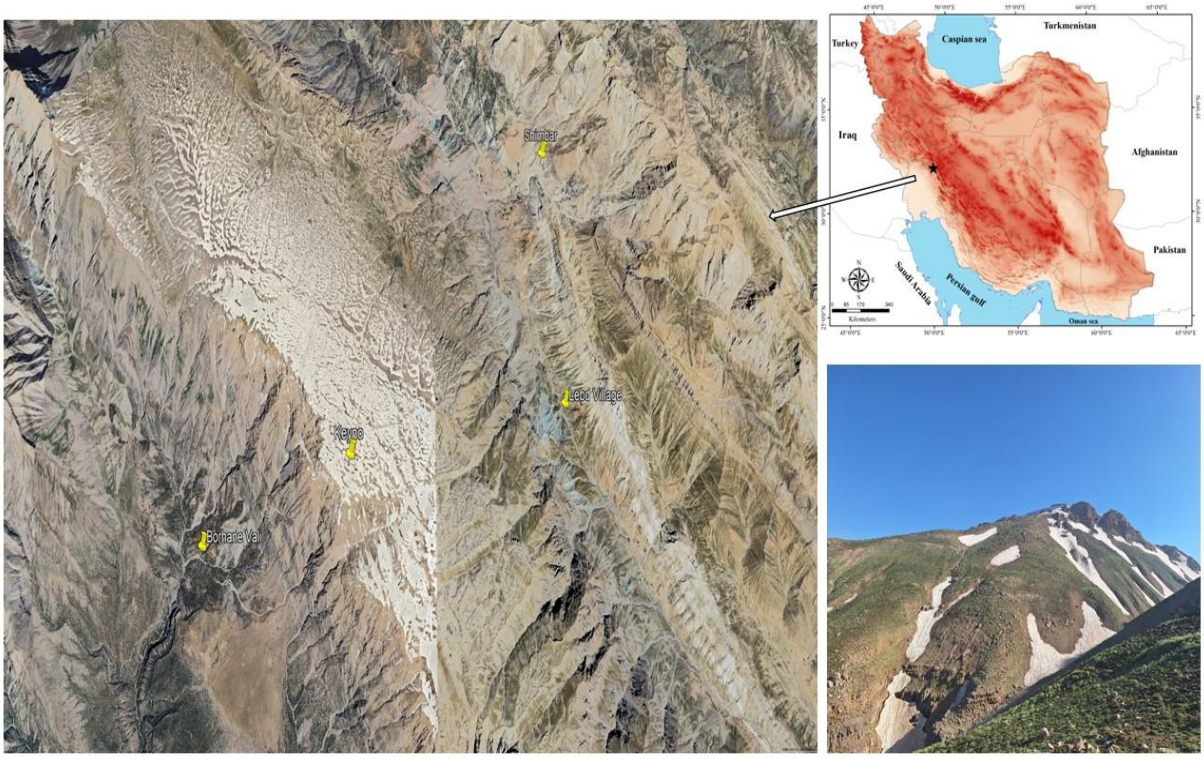

Fig. 1. A view of Mt. Keyno in Iran, with peaks and permanent glaciers on the surrounding heights.

Climate

Although Khuzestan Province, located in southwestern Iran, is not typically recognized as a tropical province, it experiences abundant rainfall and snowfall in its mountainous areas and sometimes has permanent glaciers throughout the year, similar to what happens in the higher elevations of Keyno. Most of this diversity is due to topographic factors and the proximity of seas. Ombrothermic graphs, related to the years of this research, are prepared using (2021-2024) data from synoptic stations close to Keyno (Fig. 2).

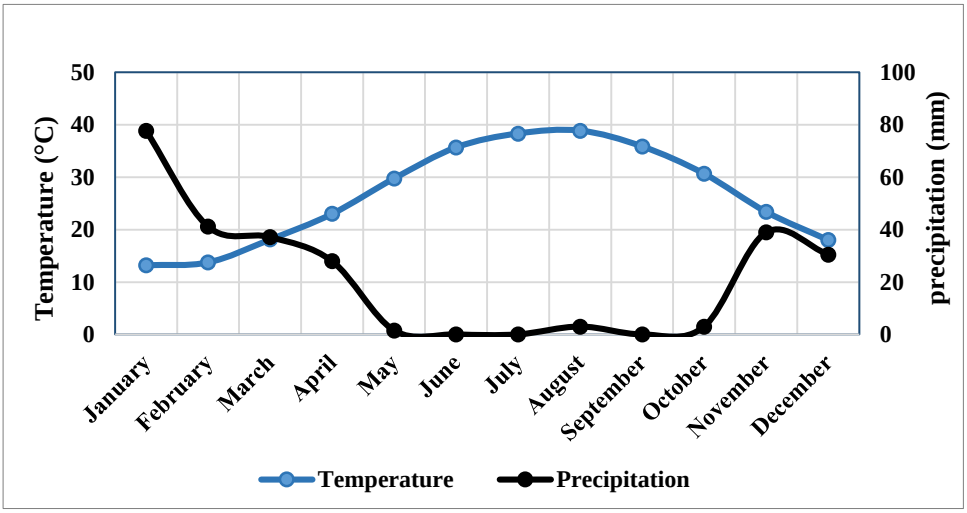

Fig 2. Ombrothermic graphs prepared using (2021-2024) data from synoptic stations close to the area.

RESULTS

Floristic composition

In this study, 151 species and 110 genera of vascular plants belonging to 38 plant families were collected from Keyno Mountain. The most prevalent families in the flora of Keyno Mountain were Asteraceae (18 species), Lamiaceae (16), Caryophyllaceae (13), Poaceae (13), Fabaceae (11), and Apiaceae (11). For better understanding, a comparison was made with the number of species in Khuzestan province (Table 1). The genera with the highest number of taxa in the alpine and subalpine zones included the genera *Astragalus* (10 species), *Cousinia* (5), and *Stachys* (4).

In the alpine and subalpine zone, most of the species belonged to the Irano-Turanian floristic region (96 species, 64%), IT/ Euro-Siberian (23, 15%), IT/Sahara-Sindian (4, 3%), IT/Mediterranean (3, 1%), IT/and multiregional (23, 15%). This is obvious, considering that Keyno is part of the Zagros Mountain Range. Species such as *Ammi majus* L. and *Phalaris paradoxa* L. were cosmopolitan (Fig. 3).

In the Keyno Mountain, 26 endemic species were identified. Most of them (17 species) are endemic to the Zagros region (Table 2), and 22 species have fewer than 4 populations in Khuzestan. The populations of many of these species, such as *Dionysia zagrica* Grey-Wilson, *Myopordon aucheri* Boiss., *Cousinia bazoftensis* Attar. and *Silene persica* Boiss. are very small and limited in Iran. Consequently, these species are severely under threat. Table 3 presents a checklist of vascular plants of the alpine and subalpine zones of Keyno Mountain.

Table 1. List of the most species-rich vascular plant families in alpine and subalpine zones.

Family	Species in Keyno	Species in Khuzestan
Asteraceae	18	132
Lamiaceae	16	48
Poaceae	13	68
Caryophyllaceae	13	39
Fabaceae	11	79
Apiaceae	11	45

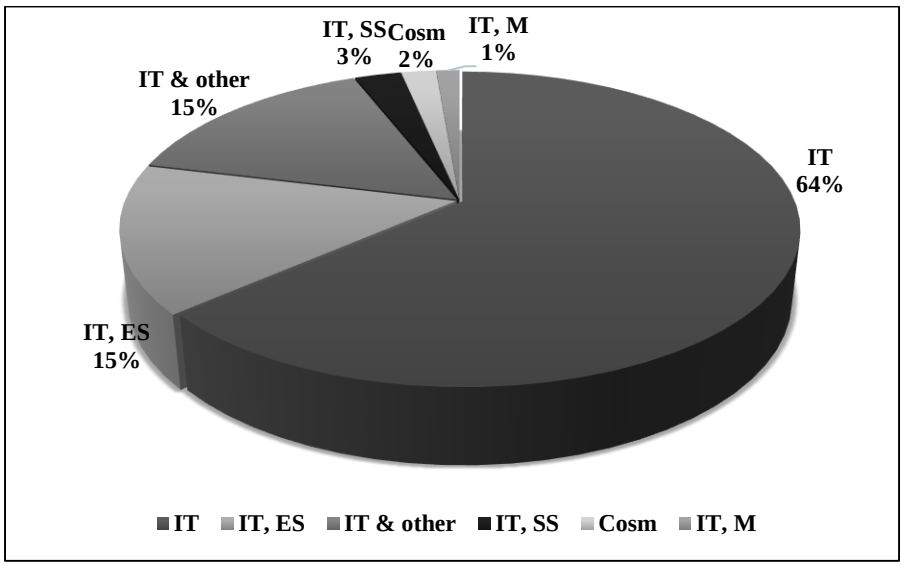

Fig 3. The proportion of the phytogeographical groups elements in Keyno (the alpine and subalpine zone). IT=Irano-Turanian; IT, ES=IT/ Euro-Siberian; IT, SS=IT/Sahara-Sindian; IT, M=IT/Mediterranean; IT & other=Irano-Turanian and other regions; Cosm=Cosmopolitan.

Table 2. The endemic species of the Keyno Mountain (alpine and subalpine zones). Iranian endemics are marked by a double asterisk (**) and Zagros endemics are marked by a single asterisk (*)

Species	Family	Distribution	Population in Khuzestan
Acantholimon melananthum Boiss.	Plumbaginaceae	*	2
Aristolochia olivieri Colleg. ex Boiss	Aristolochiaceae	**	1
Astragalus murinus Boiss.	Fabaceae	**	1
Astragalus myriacanthus Boiss.	Fabaceae	**	1
Azilia eryngioides (Pau) Hedge & Lamond	Apiaceae	*	2
Campanula humillima A. DC.	Campanulaceae	*	1
Centaurea luristanica Rech.f.	Asteraceae	*	3
Cousinia bazoftensis Attar.	Asteraceae	*	1
Cousinia cylindracea Boiss.	Asteraceae	**	1
Cyclotrichium depauperatum (Bunge.) Manden. & Schehg	Lamiaceae	*	3
Cyclotrichium straussii (Bornm.) Rech.f.	Lamiaceae	*	2
Dionysia zagrica Grey-Wilson	Primulaceae	*	1
Arenaria persica Boiss.	Caryophyllaceae	**	1
Isatis raphanifolia Boiss.	Brassicaceae	**	4
Myopordon aucheri Boiss.	Asteraceae	*	1
Nepeta kotschyi Boiss. var. *persica* (Boiss.) Jamzad	Lamiaceae	**	2
Onosma dasytricha Boiss.	Boraginaceae	*	6
Paronychia lordecanica Dinarvand & Assadi	Caryophyllaceae	*	1
Postia bombycina Boiss. & Hausskn.	Asteraceae	*	2
Pterocephalus melanobasis Pau.	Dipsacaceae	*	1
Rubia albicaulis Boiss.	Rubiaceae	*	1
Semenovia frigida (Boiss. & Hausskn.) Manden.	Apiaceae	*	1
Silene persica Boiss.	Caryophyllaceae	*	1
Stachys acerosa Boiss.	Lamiaceae	**	4
Stachys ixodes Boiss. & Husskn. ex Boiss.	Lamiaceae	*	1
Stachys pilifera Benth.	Lamiaceae	**	4

Life forms

The life forms observed in the study area were classified into the following categories: Hemicryptophytes (53 species), Therophytes (36), Chamaephytes (32), Cryptophyte-geophytes (17), and Phanerophytes (13) (Fig. 4). Images of some species in Mt. Kyno are shown in Fig. 5.

Vegetation and physiognomy

In the studied area, species diversity depends on factors such as changes in altitude, geology, the presence of permanent glaciers, and anthropogenic disturbances. The plant species are distributed across different elevation zones. The main habitat types observed in these zones included: 1. Open forests of *Quercus brantii* Lindl. (Fig. 6e), 2. The woodlands of *Juniperus excelsa* M. Bieb. (Fig. 6h), 3. *Daphne oleoides* Schreb subsp. *Kurdica* (Bornm.) Bornm. and *Daphne mucronata* Royle have formed in the upper part of the timberline, 4. Open to semi-dense shrublands of *Amygdalus scoparia* (Spach) C.K. Schneid. and *Amygdalus hausskenchtii* (C.K. Schneider) Bornm. in the lower part of the oak forest line, 5. *Dianthus orientalis* Adams, *Dinathus strictus* Banks & Soland. and *Dionysia zagrica* Grey-Wilson on rocky slopes, 6. In the snow-covered parts and glacial valleys (alpine and subalpine vegetation), thorn-cushion species were prominent (Fig. 6b), mainly as different combinations of *Astragalus* spp., *Cousinia* spp., *Onobrychis cornuta* L., 7. The tall herbs such as *Ferulago angulata* (Schlecht.) Boiss., *Semenovia frigida* (Boiss. & Hausskn.) Manden., *Tetrataenium lasiopetalum* (Boiss.) Maden, and *Cyclotrichium depauperatum* (Bunge) Manden. & Schehg (Fig. 6d) were observed in patches in different parts of the region (Fig. 6a & c)., 8. At lower altitudes, other large communities of *Astragalus brachycalyx* Fischer are observed (Fig. 6f)., 9. Riparian vegetation with *Vitex agnus-castus* L. var. *pseudo-negundo* Hausskn., *Tamarix* spp., and *Populus euphratica* Olivier forms dense thickets, especially along the Shimbar wetland, at the foothill of the Keyno Mountain.

In areas under human destruction due to livestock overgrazing or fuel supply, the species such as: *Cirsium congestum* Fisch. & C.A. Mey. and *Cirsium bracteosum* DC. were dominant.

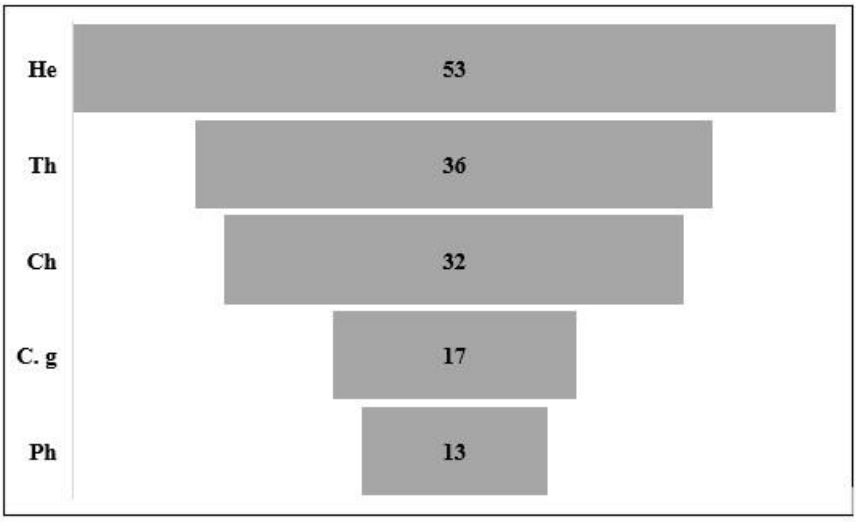

Fig 4. The most abundant vegetation form in the alpine and sub-alpine zones of Keyno (He=Hemicryptophytes; Th=Therophytes; Ch=Chamaephytes; C. g=Cryptophyte-geophytes; Ph=Phanerophytes).

DISCUSSION

Floristic composition

According to the classification of floristic regions (Zohary, 1973; Takhtajan 1986; Akhani & Samadi 2015; Assadi 1988), the study area (the Keyno mount) is located in the Irano-Turanian (IT) region on Zagros. The presence of the Mediterranean and Euro-Siberian elements is interpreted as the result of maximum precipitation, short time of freezing in winter and dry summer (Akhani & Samadi 2015; Dinarvand & al. 2015b; Dinarvand & Jamzad 2020). Khuzestan province (with 77 endemic) consists of 1.1% of Iran's endemic species especially in mountainous areas (IT region) (Dinarvand & Jamzad, 2020). In the entire Keyno region and its surroundings, 31 endemic species were identified, 26 of which were observed in the alpine zone. Generally, the high representation of endemic species in Iran belongs to the Irano-Turanian region (Akhani 2006).

Fig 5. Selected species of Keyno in their habitats; a, *Silene persica*; b, *Astragalus ovinus*; c, *Cyclotrichium depauperatum*; d, *Astragalus murinus*; e, *Astragalus myrianthus*; f, *Asperula glomerata*; g, *Myopordon aucheri*; h, *Cousinia cylindracea*; I, *Astragalus lamprocarpus* (Photos by M. Dinarvand).

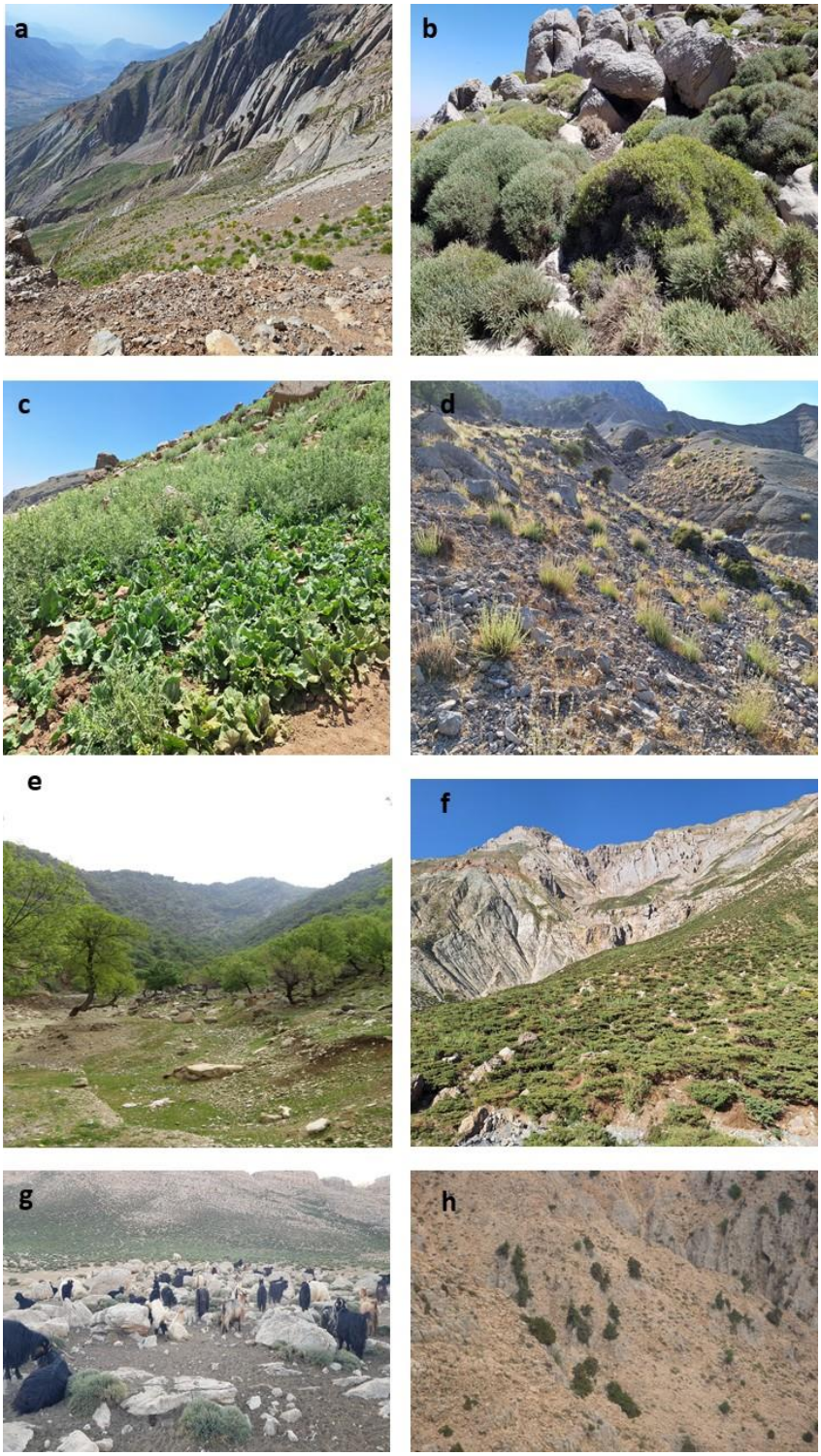

Fig 6. Characteristic landscapes on Keyno Mountain. a, *Ferulago angulata*; b, subalpine vegetation dominated by thorn-cushion plants; c, *Tetrataenium lasiopetalum*; d, *Cyclotrichium depauperatum*; e, open forests of *Quercus brantii* and *Acer monspsulanum;* f, *Astragalus barchycalyx;* g, human activities (Goat grazing); h, *Juniperus* woodlands.

The genera *Astragalus* L., *Cousinia* Cass. and *Stachys* have the highest number of endemic species on Keyno. Other studies indicate that *Astragalus* L. is a characteristic IT element (Manafzadeh & al., 2016). According to Maassoumi (2005), the total number of taxa of this genus in Iran is 804 that making this country one of the main centers of speciation for this genus. *Azilia eryngioides* (Pau) Hedge & Lamond is a monotypic genus found in the region. In this study for the first time a small population of endemic species, *Myopordon aucheri* Boiss. was discovered from the ridge of Keyno, a locality far from the type locality in Zardkuh (type locality). It is reported here as a new locality after 176 years of the first report, and a new collection for this endemic species (Dinarvand & Mozaffarian, 2022). All of the endemics in the study area represent hemicryptophyte, and chamaephyte life forms. Life forms of plant species indicated the possibility of adaptation to environmental factors, especially climatic conditions (Nafisi & Ghahremaninejad, 2014). Therophytes (33%) and Hemicryptophytes (29%) are the dominant life form in Khuzestan province (Dinarvand & Jamzad, 2020). The most abundant vegetation form on the Keyno Mountain area belongs to the Hemicryptophytes (53 species) form, but considering the entire vegetation cover of the mountain and its surroundings, the number of Therophytes (103 species) will be the largest and Hemicryptophytes (76 species) is the second. The number of therophytes often decreases with increasing elevation (Atashgahi & al., 2018). Therophytes adapted to drought and shortage of rainfall because they spend their vegetation period in the form of seed and hemicryptophytes use different ways such as reserving water, reducing their need for water by losing leaves, and using groundwater, to overcome difficult environmental conditions (Asri 2003). According to Mobayen (1981), the frequency of hemicryptophytes was due to cold and temperate climate, so, the dominance of hemicryptophytes on Keyno indicated the adaptation of the plant to cold and temperate and high lands areas. Although chamaephytes have a relatively lower contribution to the life form spectrum, they play a major role in the vegetation as suffruticose and thorny cushion formations on Zagros. Similar results were obtained in studies conducted in other alpine regions of the Zagros, such as Alvand (Dehshri & al., 2016), Hashtad mountain (Akhavan Roofigar & al., 2024), and Karsanak (Pairanj & al., 2011). Of all of them Astraceae family and *Astragalus* genus were the largest, hemicryptophytes were the dominant life form and most of the species belonged to Irano-Turanian region.

Riparian forests along Shimbar wetland, on the foothills of Keyno, open oak forests, *Juniperus* woodlands and open to semi-dense shrublands on Zagros are the main habitats of phanerophytes. The species in the study area have traditionally been used for grazing, harvesting for firewood, winter forage, and medical or food purposes. The most important medicinal plants include *Tetrataenium lasiopetalum*, *Allium tripedale*, *Ziziphora clinopodioides* Lam., *Ferulago angulata.*, *Prangos haussknchtii*, *Astragalus* spp., etc.

Endangered species and threat factors

The harsh climate, global warming, human activities, such as grazing (Fig. 6g), excessive collection of medicinal and edible plants, civil activities, agriculture, and changing aquatic resources, are major reasons for the gradual reduction of species richness. Most endemic species in the Zagros region, including those on Keyno are critically endangered due to various IUCN factors such as limited Area of Occupancy and Extent of Occurrence, small population size, poor habitat quality, and issues with nature regeneration. According to Table 3, most endemic species in this region have very limited habitats and small population sizes. Recent research on some plants has shown that some are in danger of being extinction from nature. For example, the species such as *Myopordon aucheri* Boiss. (Dinarvand & Mozaffarian, 2022), *Cyclotrichium depauperatum* (Bunge.) Manden. & Schehg (Dinarvand & al., 2023), *Mandragora autumnalis* Bertol (Dinarvand & al., 2023), *Azilia eryngioides* (Pau) Hedge & Lamond **(**Mehrnia & al., 2020) in the Zagros region, including those on the Keyno mountain, are critically endangered due to various factors, especially such as limited Area of Occupancy (AOO), Extent of Occurrence (EOO), small population sizes. These plants require strong conservation and protection management since the fragile ecosystems are often very restricted, small, and isolated (Noroozi, & al., 2007), nonetheless grazing and overgrazing are still common threats. Therefore, considering the habitat conditions, it needs special attention and full protection. Conservation outside the habitat (Ex situ), such as botanical gardens, seed collection and storing them in the National Gene Bank, enclosure region, or conservation in the main habitat (In situ), are among the appropriate solutions proposed for conserving these species.

ACKNOWLEDGMENT

We wish to thanks of "Department of Environment of Khuzestan" because of field collaborations and Dr. S.H. Arami for helping in the preparation of the maps.

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Table 3. Checklist of vascular plants of Keyno Mountain (alpine and sub-alpine). Life-forms: Ch (chamaephyte), C. g cryptophyte geophyte), C.h (cryptophyte hydrophyte), He (hemicryptophyte), Ph (phanerophyte), Th (therophyte). Chorotypes: IT: Irano-Turanian, ES: Euro-Siberian, M: Mediterranean, SS: Sahara-Sindian, Cosm: Cosmopolitan. *indicates endemic species.

Species	Life forms	Chorotypes	Herbarium. No
Aceraceae			
Acer monspsulanum L.	Ph	IT	10244
Alliaceae			
Allium tripedale Trautv.	C. g	IT	10558
Allium jesdianum Boiss. & Buhse	C. g	IT	10998
Amaryllidaceae			
Ixiolirion tataricum (pall.) Herb	C. g	IT, ES, SS	900
Apiaceae			
Ammi majus L.	Th	Cosm	1007
Azilia eryngioides (Pau)Hedge & Lamond*	He	IT	10910
Ferulago angulata (Schlecht.) Boiss.	He	IT	10954
Prangos haussknchtii Boiss.	He	IT	10921
Prangos uloptera DC.	He	IT, ES	10324
Scandix pecten-veneris L.	Th	IT, ES	5545

Table 3. continued.

Species	Life forms	Chorotypes	Herbarium. No
Semenovia frigida (Boiss. & Hausskn.) *Manden.* *	Ch	IT	11021
Smyrniopsis aucheri Boiss.	He	IT	10322
Smyrnium cordifolium Boiss.	He	IT	7550
Tetrataenium lasiopetalum (Boiss.) Maden.	He	IT	10905
Zosima absinthifolia (Vent.) Link	Ch	IT, ES	10684
Araceae			
Arum conophalloides Ky. Ex Schott	C. g	IT	10675
Biarum carduchorum (Schott) Engl.	C. g	IT	10551
Aristolochiaceae			
Aristolochia olivieri Collengo*	He	IT	10326
Asclepiadaceae			
Marsdenia erecta (L.) R. Br.	Ph	IT	4777
Aspleniaceae			
Ceterach officiarum Lam. et DC.	C	IT, ES	10251
Asteraceae			
Aegopordon berardioides Boiss.	He	IT	4056
Atremisia haussknechtii Boiss.	Ch	IT	10953
Centaurea luristanica Rech. f. *	He	IT	10435
Cirsium bracteosum DC.	He	IT	11026
Cirsium congestum Fisch. & C. A. Mey.	He	IT	11027
Cousinia bazoftensis Attar. *	He	IT	57711
Cousinia calocephala Jaub. & Spach	He	IT	11009
Cousinia cylindracea Boiss. *	He	IT	10913
Cousinia lasiolepis Boiss.	He	IT	11019
Cousinia stenocephala Boiss.	He	IT	11011
Crepis sancta (L.) Babcock subsp. *obovata* (Boiss. & Noe) Babcock	Th	IT, ES, SS	10071
Helichrysum armenium DC.	He	IT	10567
Helichrysum oligocephalum DC.	He	IT	10964
Myopordon aucheri Boiss. *	He	IT	10909
Postia bombycina Boiss. & Hausskn. *	Ch	IT	5258
Scorzonera radicosa Boiss.	Ch	IT, ES	11030
Steptorrhamphus tuberosus (Jacq.) Grossh.	He	IT, ES	11031
Tanacetum polycephalum Schultz-Bip. *subsp. polycephalum*	Ch	IT	10691
Brassicaceae			
Aubrieta parviflora Boiss.	He	IT	10704
Biscutella didyma L.	Th	IT, SS, M	10086
Clypeola jonthlaspi L.	Th	IT, ES, M	10311
Erophila verna (L.) Besser	Th	IT, ES	10312
Fibigia macrocarpa (Boiss.) Boiss.	Th	IT	10406
Isatis raphanifolia Boiss. *	Th	IT	7435

Table 3. continued.

Species	Life forms	Chorotypes	Herbarium. No
Campanulaceae			
Asyneuma persicus (A. DC. in DC.) Bornm.	He	IT	10653
Campanula cecilii Rech. f. & Schiman-Czeika	Th	IT	10465
Campanula humillima A. DC. *	He	IT	8575
Legouesia falcata (Ten.) Fritsch	Th	IT	10707
Michauxia laevigata Vent.	He	IT	3092
Caryophyllaceae			
Arenaria balansae Boiss.	Th	IT	11032
Arenaria persica Boiss. *	Ch	IT	11033
Cerastium glomeratum Thuill.	Th	IT, ES, M, SS	10315
Dianthus orientalis Adams	Ch	IT	10668
Dinathus strictus Banks & Soland.	Ch	IT	10170
Herniaria glabra L.	He	IT, ES, M	8983
Minartia hybrida (Vill.) Schischk. subsp. *hybrida*	Th	IT, ES, M	10317
Paronychia lordecanica Dinarvand & Assadi*	He	IT	11034
Silene eriocalycina Boiss.	He	IT	8978
Silene lagenocalyx Fenzl ex Boiss.	Th	IT	10112
Silene persica Boiss. *	Ch	IT	11035
Stellaria apetala Ucria	Th	IT, ES, SS, M	10316
Telephium oligospermum Steud. ex Boiss.	He	IT	10966
Chenopodiaceae			
Chenopodium album L. subsp. *album*	Th	IT, ES, M	8977
Chenopodium foliosum Aschers.	Th	IT, ES	9023
Convolvulaceae			
Convolvulus chondrillioides Boiss.	Ch	IT	10590
Crassulaceae			
Rosularia sempervivum var. *glabrum* (Raymond-Hamet) Assadi	He	IT	10711
Umbilicus intermedium Boiss.	C.g	IT, ES	10696
Cupressaceae			
Juniperus excelsa M. B.	Ph	IT, ES	10478
Dipsacaceae			
Pterocephalus melanobasis Pau. *	He	IT	9022
Pterocephalus plumosus (L.) Coulter	Th	IT, ES	10697
Euphorbiaceae			
Euphorbia denticulata Lam.	He	IT	4771
Euphorbia eriophora Boiss.	Th	IT, ES	10226
Euphorbia helioscopia L.	Th	IT, ES, M	10292
Fabaceae			
Astragalus adscendens Boiss. & Hausskn.	Ch	IT	1974

Table 3. continued.

Species	Life forms	Chorotypes	Herbarium. No
Astragalus barchycalyx Fischer	Ph	IT	10999
Astragalus carduchorum Boiss. & Hausskn.	Ch	IT	11036
Astragalus denudatum Steven.	Ch	IT, ES	11037
Astragalus faciculifolius Boiss.	Ph	IT, SS	4778
Astragalus lamprocarpus Maassomi	Ch	IT	11038
Astragalus murinus Boiss. *	Ch	IT	10916
Astragalus myriacanthus Boiss. *	Ch	IT	10901
Astragalus obtusifolius DC.	He	IT, SS	10405
Astragalus ovinus Boiss.	Ch	IT	10992
Ononis spinosa L.	He	IT	11017
Gentianaceae			
Gentiana olivieri Griseb.	He	IT	10122
Lamiaceae			
Cyclotrichium depauperatum (Bunge.) Manden. & Schehg*	Ch	IT	10908
Cyclotrichium straussii (Bornm.) Rech. f. *	Ch	IT	10912
Marrubium astracanicum Jacq.	He	IT	11001
Marrubium vulgar L.	He	IT	10995
Micromeria myrtifolia Boiss. & Hohen.	He	IT	10914
Nepeta fissa C. A. Mey.	Ch	IT, ES	9000
Nepeta glomerulosa Boiss.	Ch	IT	10716
Nepeta kotschyi Boiss. var. *persica* (Boiss.) Jamzad*	Ch	IT, SS	9006
Phlomis anisodonta Boiss. Subsp. *occidentalis* Jamzad	He	IT	10902
Phlomis polioxantha Rech. f.	He	IT	11000
Scutellaria multicaulis Boiss.	Ch	IT, ES	11028
Stachys acerosa Boiss. *	Ch	IT	10904
Stachys ballotiformis Vatke	Ch	IT	10714
Stachys ixodes Boiss. & Husskn. ex Boiss. *	Ch	IT	10715
Stachys pilifera Benth. *	Ch	IT	10956
Ziziphora cliopodioides Lam.	Ch	IT, ES	11009
Liliaceae			
Asphodelus tenuifolius Cav.	C. g	IT, SS	10077
Ornithogalum brachystachys K. Koch.	C. g	IT	10703
Scilla belli Baker	Th	IT, SS	10288
Moraceae			
Ficus carica L.	Ph	IT, ES, SS	10397
Myrtaceae			
Myrtus communis L.	Ph	IT, ES, M	10226
Plumbaginaceae			
Acantholimon melananthum Boiss. *	Ch	IT	10907

Table 3. continued.

Species	Life forms	Chorotypes	Herbarium. No
Poaceae			
Aegilops triuncialis L.	Th	IT, ES, SS	10139
Bromus danthomiae Trin. var. *danthomiae*	Th	IT, ES, SS	10547
Bromus sterilis L.	Th	IT	10133
Cynodon dactylon (L.) Pers.	C	IT, ES, SS	10093
Eremopoa persica Trin. var. *persica*	Th	IT, ES	10539
Heteranthelium piliferum (Banks & Soland.) Hoschst	Th	IT, M	10053
Hordeum bolbusa L.	C	IT, ES, M	10120
Lolium rigidum Gaudin	Th	IT	956
Melica persica Kunth	He	IT	10240
Oryzopsis holciformis (M. B.) Hack. var. *holciformis*	He	IT	10712
Phalaris paradoxa L.	Th	Cosm	4788
Polypogon semiverticillatus (Forssk.) Hyl.	Th	IT, ES, M	7389
Poa bulbosa L.	C	IT, ES, M	10254
Primulaceae			
Dionysia zagrica Grey-Wilson*	Ch	IT	10745
Ranunculaceae			
Anemone coronaria L.	C	IT	10743
Delphinium cyphoplectrum Boiss.	He	IT	5027
Ranunculus asiaticus L.	C	IT, SS, M	10275
Ranunculus chius DC.	Th	IT, ES, M	10274
Ranunculus muricatus L.	Th	IT, ES	10115
Rosaceae			
Amygdalus hausskenchtii (C. K. Schneider) Bornm.	Ph	IT	10532
Cerasus brachypetala Boiss.	Ph	IT	10282
Cerasus microcarpa (C. A. Mey.) Boiss. subsp. *microcarpa*	Ph	IT	10283
Potentilla speciosa Willd.	He	IT	10973
Sanguisorba minor Scop. var. *muricata* (Spach) Briq.	He	IT, ES	10281
Rubiaceae			
Asperula glomerata (M.B.) Grisch.	Th	IT	1958
Callipeltis cucullaria (L.) DC.	Th	IT, ES	10285
Galium aparine L.	Th	IT, ES, M	10284
Galium psilocladum Ehrend.	Th	IT, ES	11040
Rubia albicaulis Boiss. *	Ch	IT	11008
Theligonum cynocrambe L.	Th	IT, ES	10056
Scrophulariaceae			
Linaria nurensis Miller	He	IT	11022
Verbascum alceoides Boiss. & Hausskn.	He	IT	10696

Table 3. continued.

Species	Life forms	Chorotypes	Herbarium. No
Verbascum pseudo-digitalis Nab.	He	IT	10109
Veronica campylopoda Boiss.	He	IT	10955
Sinopteridaceae			
Cheilanthes fragrans (L.) Swartz	C	Cosm	10250
Solanaceae			
Hyoscyamus senecionis Willd. var. *senecionis*	He	IT	8984
Hyoscyamus senecionis Willd.	He	IT	10267
Mandragora autumnalis Bertol.	He	IT, M	8960
Thymelaeaceae			
Daphne mucronata Royle	Ph	IT	10238
Daphne oleoides Schreb subsp. *Kurdica* (Bornm.) Bornm.	Ph	IT	10237
Urticaceae			
Parietaria judaica L.	C	IT, ES, SS	10252
Valerianaceae			
Valeriana sisymbrifolia Vahl	C	IT, ES	10254
Verbenaceae			
Verbena officinalis L.	He	IT, ES, SS	11007
Vitaceae			
Amplopsis vitifolia (Boiss.) Planch.	Ph	IT	10951