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ALPINE AND SUB-ALPINE FLORISTIC SURVEY OF HASHTAD MOUNTAIN (CENTRAL ZAGROS), IRAN

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The Hashtad Mountain, with an elevation of approximately 3770 m.a.s.l., is one of the highest peaks of the Zagros Mountains in the west of Isfahan province. The objective of the present work was to study the flora of this mountain across different altitudinal ranges. The results showed that Hashtad Mountain has a rich flora with a high plant diversity. A total of 212 taxa belonging to 39 families and 135 genera were identified. Asteraceae, represented by 27 species, was the largest family, followed by Fabaceae and Lamiaceae with 26 and 20 species, respectively. *Astragalus*, with 21 species, was identified as the largest genus. The region was dominated by hemicryptophytes (59%) and chamaephytes (13.7%) in terms of life form. In terms of geographical distribution, 65.5% of the identified species belong to the Irano-Turanian region. 63 species (29.7%) were endemic to Iran, with 21 species (9.9%) specifically endemic to the Zagros, highlighting the area's rich biodiversity. However, mining, road construction, and overgrazing are significant threats to the biodiversity of this area. Protection measures, including defining protected areas and regulating human activities, are necessary to conserve the biodiversity of Hashtad Mountain.

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Keywords: Biodiversity; conservation; endemism; floristic study; Isfahan

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کوه هشتاد با ارتفاع ۳۷۷۰ متر از سطح دریا، یکی از قله‌های مرتفع رشته کوه های زاگرس در غرب استان اصفهان به شمار می‌آید. مطالعه حاضر با هدف بررسی فلور این کوه در مناطق ارتفاعی مختلف انجام شد. نتایج این مطالعه نشان‌دهنده وجود تنوع بالای گونه‌های گیاهی در این منطقه است، در مجموع در این مطالعه ۲۱۲ آرایه متعلق به ۳۹ تیره و ۱۳۵ جنس شناسایی شدند. Asteraceae با ۲۷ گونه بزرگترین تیره گیاهی بوده و تیره‌های Fabaceae و Lamiaceae به ترتیب با ۲۶ و ۲۰ گونه در رتبه‌های بعدی قرار گرفتند. در این میان جنس گون (Astragalus) با ۲۱ گونه به‌عنوان بزرگترین جنس شناخته شد. فراوان‌ترین شکل زیستی در این مطالعه همی‌کریپتوفیت‌ها (۵۹٪) و کامفیت‌ها (۱۳/۷٪) بودند. علاوه‌براین، از نظر پراکندگی جغرافیایی، ۶۵/۵٪ از گونه‌های شناسایی شده به منطقه ایرانی-تورانی تعلق داشتند. نتایج این مطالعه نشان داد که ۶۳ گونه (۲۹/۷٪)

انحصاری ایران هستند، و از این میان ۲۱ گونه (۹/۹٪) به‌طور خاص انحصاری زاگرس هستند که نشان‌دهنده تنوع زیستی بالای این منطقه است. با این حال، معدن‌کاوی، ساخت جاده و چرای مفرط دام، تهدیدات مهمی برای تنوع زیستی این منطقه محسوب می‌شوند. اقدامات حفاظتی از جمله ایجاد مناطق حفاظت شده و مدیریت فعالیت‌های انسانی، برای حفظ تنوع زیستی کوه هشتاد ضروری است.

INTRODUCTION

The presence of two major phytogeographical kingdoms, Holarctic and Paleotropical, including the Irano-Turanian, Euro-Siberian, and Saharo-Sindian regions, has resulted in the formation of diverse biomes and habitats, including forests, plains, deserts, aquatic environments, and mountainous areas with peaks exceeding 4000 m in Iran (Noroozi & al. 2008). The majority of Iran's high-altitude areas belong to the Alborz and Zagros Mountain ranges (Jafari & al. 2014). The rocky paths and long hikes make it hard to reach these areas, so there's been little research on the plant diversity there. Altitude plays a critical role in the distribution of plant species in mountainous regions. The Earth's altitudinal zonation is generally divided into four main zones: the nival zone, the alpine zone, the montane zone, and the lowland zone (Jafari & al. 2015). The definition of alpine flora varies globally, influenced by factors such as latitude.

Generally, the alpine zone is defined as the altitude range above the tree line and below the nival 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. (2008) describe the alpine zones in the Alborz range as ranging from 3000 to 4000 m, with the nival zone above 4000 m. There is a paucity of sources that have studied the flora of high-altitude mountain regions, although some studies have been conducted (Pairanj & al. 2011; Rajai & al. 2011; Dehshiri & al. 2016; Dehshiri & Mahdavar 2016; Amini Rad 2020; Amini Rad & Pahlevani 2022; Mahmoodi & al. 2022; Moghanloo & al. 2023; Razbani & al. 2023). Further studies by Noroozi and colleagues have reinforced the notion of the biodiversity and phytogeography of Iran's alpine flora (Noroozi & al. 2008; 2014; 2016).

The climate in the Zagros Mountains, where Hashtad Mountain is situated, features cold, wet winters and hot, dry summers. Precipitation is unevenly distributed, with higher elevations receiving more rainfall, frequently in the form of snow, which supports the region's diverse vegetation (Noroozi & al. 2020). The region experiences a Mediterranean climate pattern, characterized by cold, wet winters and warm, dry summers. The varying climatic conditions across the Zagros Mountains create multiple microclimates that accommodate a diversity of plant species. These specific climatic factors, including temperature fluctuations and precipitation patterns, are crucial in determining the plant diversity observed on Hashtad Mountain. According to Archibold (1995), the dominance of hemicryptophytes in areas with such climates indicates a cold and mountainous environment.

In the contemporary era, the expansion of human populations and the increasing prevalence of environmental threats, including land-use changes, climate change, road construction, and particularly overgrazing, have resulted in the deterioration of numerous plant habitats, including those in mountainous regions (Díaz & al. 2019). Globally, ecological studies and biodiversity assessments identify priority habitats based on high plant species diversity, endemics, rare, and endangered species, and species with ornamental, medicinal, and other properties. Subsequently, these habitats are subjected to protective management.

Examining the local flora, collecting specimens with comprehensive details, and completing herbarium collections will greatly enrich botanical knowledge and deepen our understanding of plant geography and diverse habitats in these regions. Hashtad Mountain, situated in the western part of Isfahan Province, is regarded as one of the most significant mountains in the region. The 3770 m peak of Hashtad Mt. is located in Fereydunshahr County, Isfahan Province. The objectives of this study are to assess the species diversity and identify endemic species within the region, analyze the factors contributing to their vulnerability, and recommend conservation measures to protect and preserve the region's biodiversity.

MATERIALS AND METHODS

Study area

Hashtad Mt. is situated in the western region of Isfahan Province, within the administrative boundaries of Fereydunshahr County. The study area encompasses the alpine and sub-alpine zones of Hashtad Mt., with an elevation range from 2700 to 3770 m. The geographic coordinates of the highest peak (3770 m) are approximately N 33°00'50" and E 49°57'49". The definition of the alpine or subalpine elevation range is

based on previous studies (Noroozi & al. 2020) in similar regions of the Zagros Mountains. Specifically, in the context of the Zagros Mountains, the tree line often occurs around this elevation, marking the beginning of the subalpine and alpine zones characterized by the absence of trees and the dominance of alpine vegetation. The mountain is bordered by several villages and counties including in the north, Moghandar; in the south, Chogyurt; in the east, Aghche; and in the west, Gurab. The main ways to access the peak of this mountain are through the villages of Aghche, Aga Gol, Tange Doozan and Haji Abad. Fieldwork was conducted during the growing seasons from 2022 to 2024. The region experiences various climatic conditions due to its location in the Zagros Mountains (Fig. 1).

Fig. 1. A view of Hashtad Mountain, showing various elevation zones and topographical features of the study area in the Central Zagros. An arrow indicates the peak of Hashtad Mountain (approximately 3770 m).

Data collection and sampling method

The initial identification of the study area was based on preliminary data. A general survey of the vegetation was conducted on the mountain, in various slopes. Plant specimens were collected from 2022 to 2024, during the growth period, which begins mid-spring and lasts until early summer.

21 excursions were conducted during these years, covering all main slope directions and elevations of Hashtad Mountain. A systematic approach was employed for the plant collection, to ensure that samples were gathered from all slope directions based on the topographical features of the region. Plant specimens were collected from each elevation zone. The classification of zones was based on previous studies and local vegetation characteristics, where elevations above 2500-2700 m were considered sub-alpine and alpine zones due to the presence of typical alpine vegetation and the absence of tree cover. Elevations below 2500 m were classified as mountain zones. A significant proportion of the collected samples were from the sub-alpine and alpine zones (2700 to 3770 m), while fewer specimens were from the mountain zone (below 2500 m). During collection, geographic coordinates, habitat details, and photographs of the species were recorded. The specimens were collected, dried, mounted on herbarium sheets, labeled with their specific information (including scientific names, family names, herbarium number, altitude, coordinates, collector's name, and collection date), and deposited at the SFAHAN and TARI herbaria. Furthermore, specimens collected in previous years by other botanists from Hashtad Mountain and stored at the SFAHAN herbarium were also included in the dataset. The plant specimens were identified using relevant botanical

references, including Flora Iranica (Rechinger, 1963-2015) and Flora of Iran (Assadi & al. 1988-2023), as well as monographs and checklists (Fritsch & Abbasi 2013; Podlech & Zarre, 2013; Maassoumi, 2022). The Raunkiaer system (Raunkiaer 1934) was employed to classify life forms, and these classifications were verified through field observations during the study. Chorotypes were determined following Zohary (1973) and White & Leonard (1991). Furthermore, the list of identified species was compiled using data from Flora of Iran (Assadi & al. 1988-2023) and, where necessary, verified with Plants of the World Online (POWO).

RESULTS

Species diversity

In this study, a total of 400 specimens were collected from Hashtad Mt., of these, 212 species from 135 genera and 39 families were recorded from the alpine and sub-alpine zones (Figs. 2 & 3, and Table 1). The most prevalent family in the flora of Hashtad Mt. was Asteraceae, which included 18 genera (13.3%) and 27 species (12.7%). The next prevalent family was Fabaceae, with six genera (4.4%) and 26 species (12.2%). Lamiaceae represented ten genera (7.4%) and 20 species (9.4%), while Apiaceae with 13 genera (9.6%) and 17 species (8%), followed by Brassicaceae comprised 12 genera (8.8%) and 16 species (7.5%), Caryophyllaceae (seven genera and 12 species), and Poaceae (nine genera and 11 species), respectively. The genera with the highest taxa included *Astragalus* L. with 21 species (9.9%), *Euphorbia* L., *Allium* L., and *Stachys* L. each with 5 species (2.3%). The remaining genera had fewer than five species each, as detailed in Table 1.

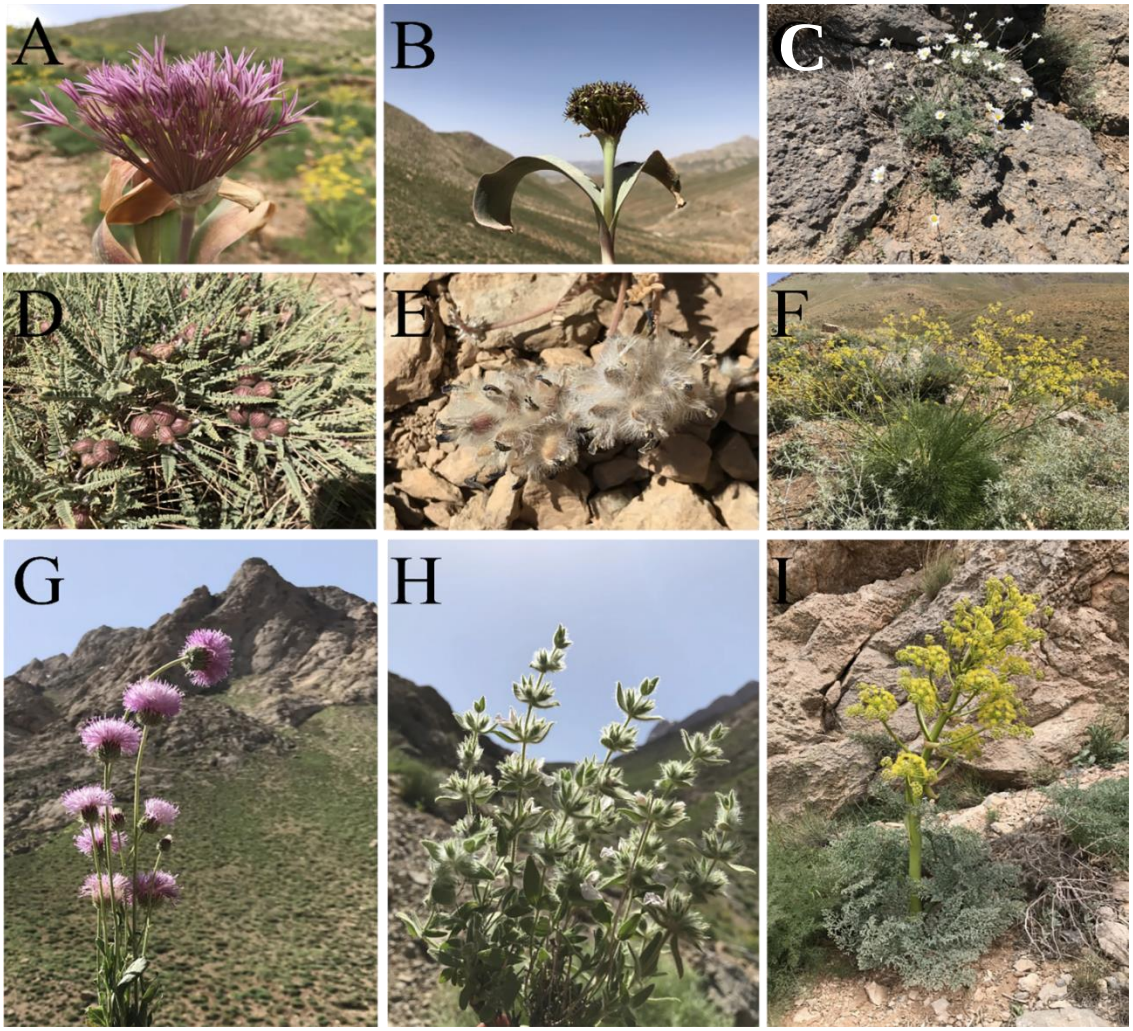

Fig. 2. Representative plant species from Hashtad Mountain: A, *Allium ubipetrense*; B, *A. minutiflorum*; C, *Tanacetum persicum*; D, *Astragalus murinus*; E, *A. inexpectatus*; F, *Ferulago angulata*; G, *Jurinea meda*; H, *Stachys pilifera*; I, *Ferula assa-foetida*.

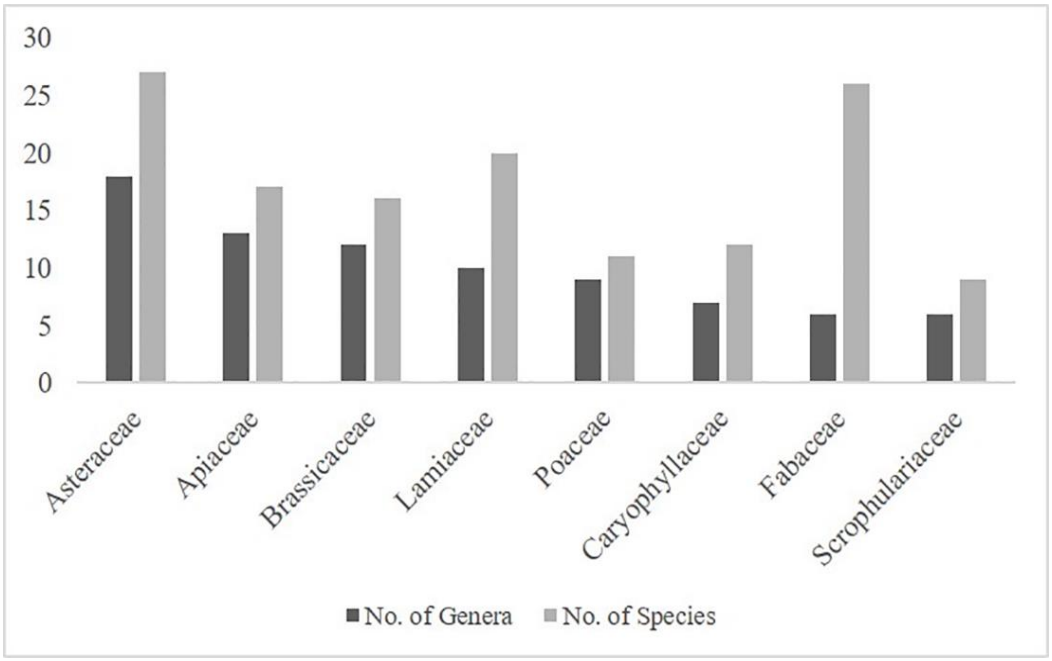

Fig. 3. The number of genera and species in each family in Hashtad Mt. (only the 8 largest families are shown).

Life forms

The life forms observed in the study area were classified into the following categories: hemicryptophytes (125 species, 59%), chamaephytes (29 species, 13.7%), geophytes (26 species, 12.2%), therophytes (24 species, 11.3%), and phanerophytes (8 species, 3.8%). Hemicryptophytes were the most common life-forms observed, followed by chamaephytes and geophytes (Fig. 4).

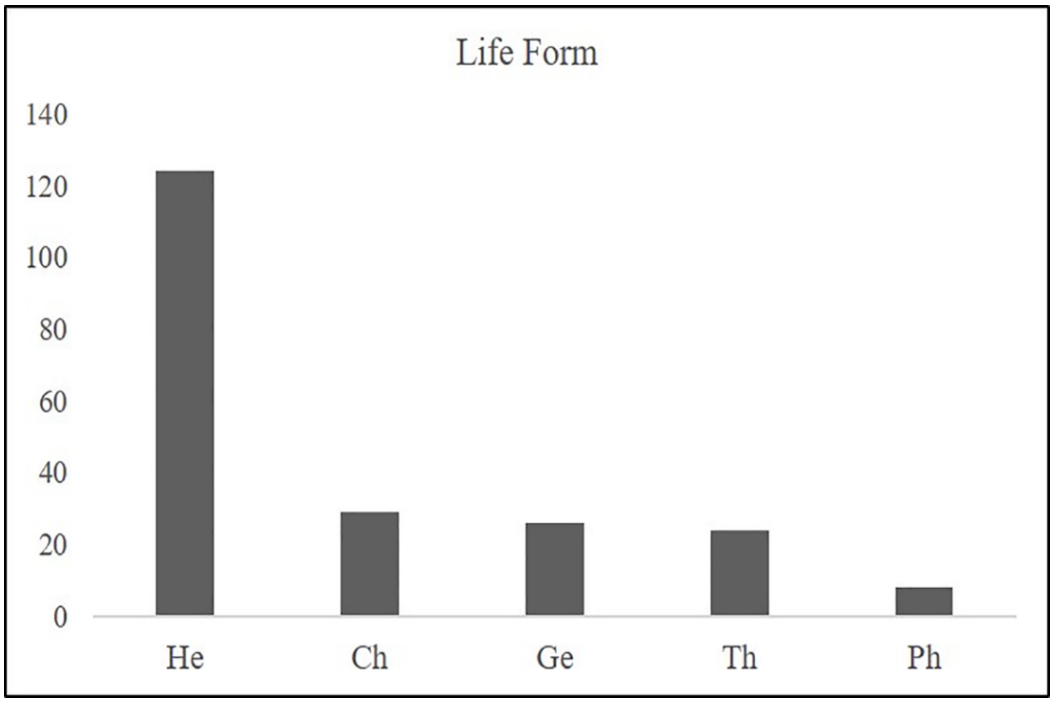

Fig. 4. The life forms of taxa on Hashtad Mountain: Ch, chamaephytes; Ge, geophytes; He, hemicryptophytes; Ph, phanerophytes; Th, therophytes.

Chorotypes

The most common chorotype was Irano-Turanian (IT), accounting for 65.5% of the species (139 species). Other chorotypes included IT/Euro-Siberian (30 species), IT/ES/Mediterranean, (19 species), IT/M (4 species), IT/ES/Saharo-Sindian, (2 species), IT/SS (2 species), IT/M/SS (1 species), cosmopolitan (4 species), and multiregional (10 species) (Fig. 5).

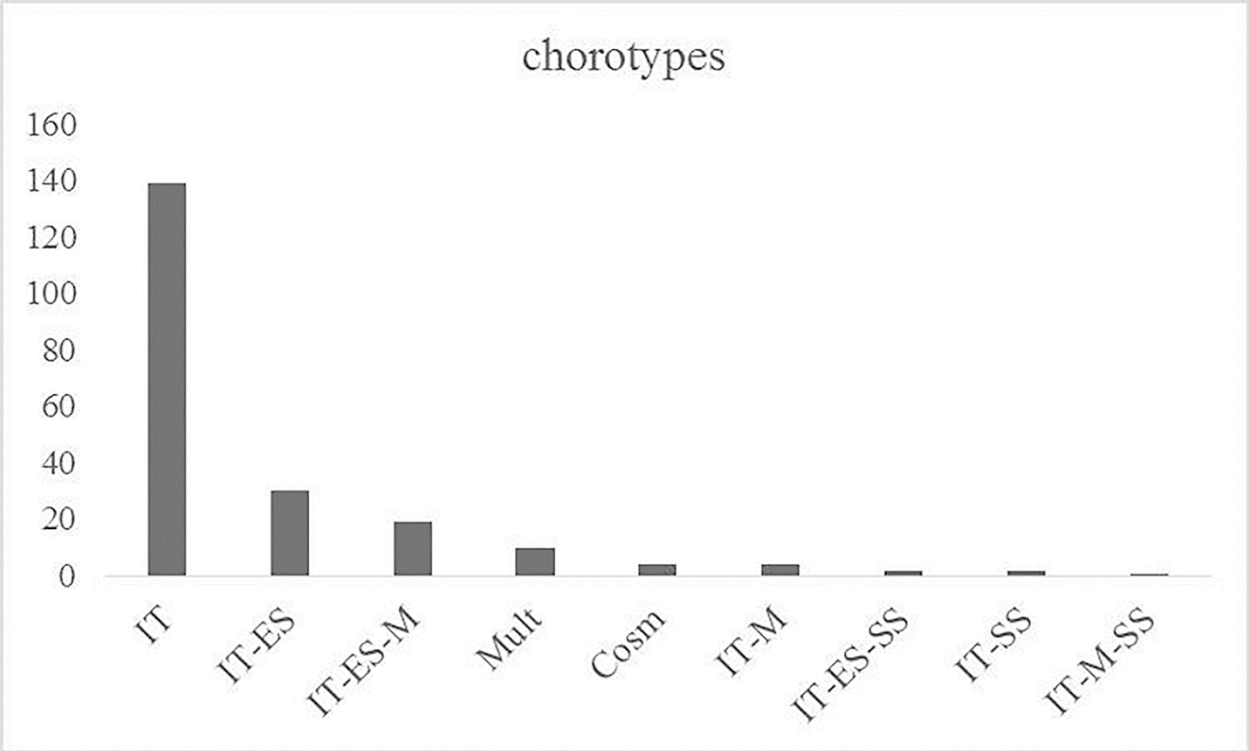

Fig. 5. The chorotypes of taxa on Hashtad Mountain: IT, Irano-Turanian; ES, Euro-Siberian; M, Mediterranean; SS, Saharo-Sindian; Cosm, Cosmopolitan; Mult, Multiregional.

Endemic and rare species

A total of 63 Iranian endemic species (29.7%) were identified in the study area, of which 21 species (9.9%) are also endemic to the Zagros region (see Table 1). The largest group of endemic species belonged to the genus *Astragalus*, with 13 species, making it the most significant genus in terms of endemism. Fabaceae had the highest number of endemic species, highlighting its importance in the region's flora. *Astragalus lignipes* is particularly noteworthy. This species was first described from Fereydunshahr (Akhavan & Maassoumi 2020). Our study has confirmed the presence of *A. lignipes* in Hashtad Mountain, indicating that its distribution extends beyond the type locality. This finding is significant as it represents the first documentation of *A. lignipes* outside of its initial discovery site, enhancing our understanding of its range and ecological preferences.

Some notable endemics and rare species include *Allium austroiranicum*, *A. minutiflorum*, *A. ubipetrense*, *Amygdalus haussknechtii*, *Astragalus chartostegius*, *A. inexpectatus*, *A. johannis*, *A. lignipes*, *A. murinus*, *Convolvulus urosepalus*, *Cousinia bachtiarica*, *Dionysia bazoftica*, *Stachys acerosa*, and *Zeravschania aucheri*, highlighting the unique biodiversity of the region and emphasizing the need for focused conservation efforts.

Habitat

The plant species are distributed across different elevation zones. The main habitat types observed in these zones included rocky slopes, thorn-cushion, tall herbs, umbelliferous types, and mountain steppe (Table 1 and Fig. 6).

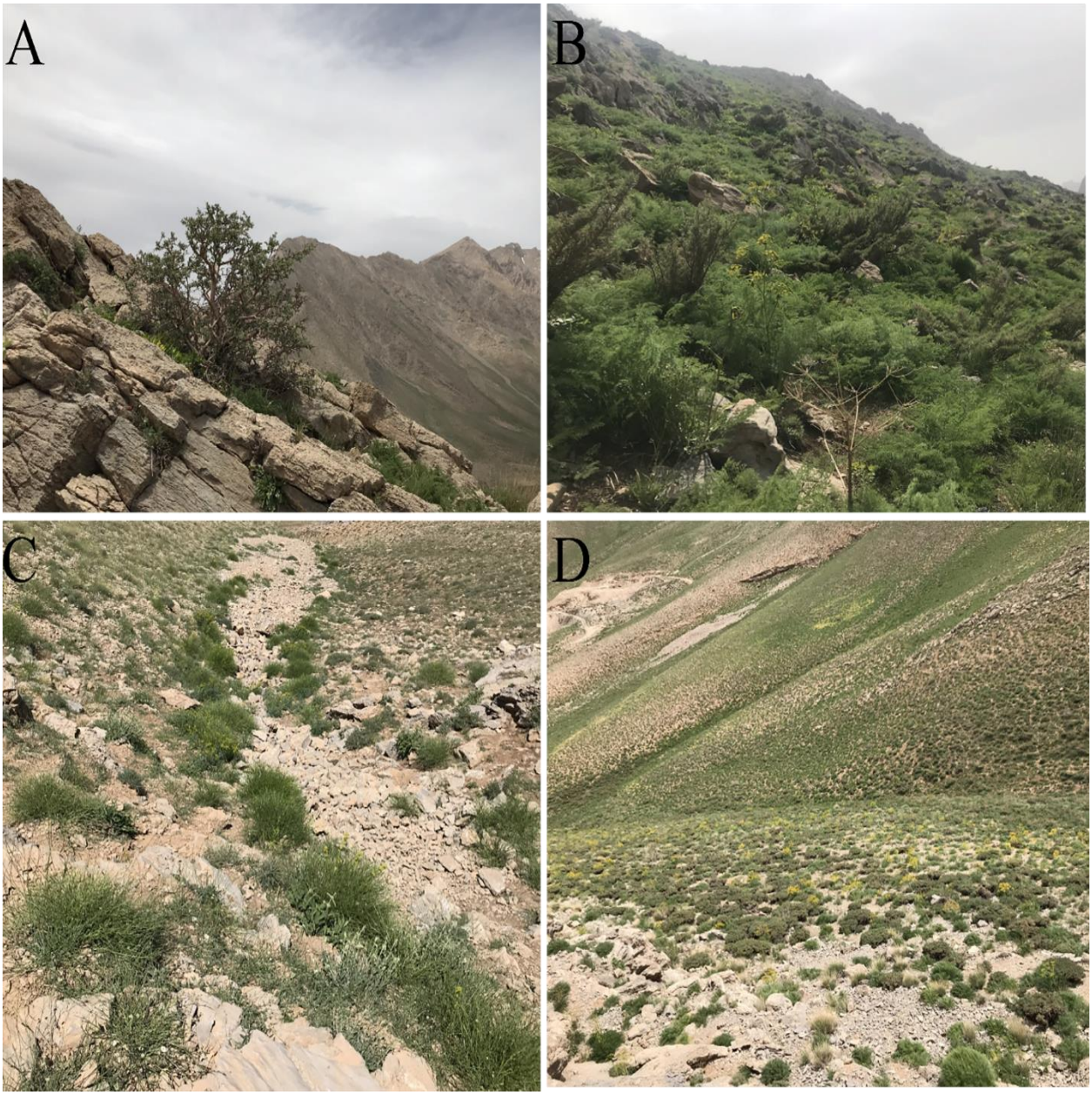

Fig. 6. Representative vegetation and topographical features of Hashtad Mountain: A, 3300-3500 m; B, 2800-3000 m; C, 3100-3200 m; D, 2900-3200 m.

Edible and medicinal plants

Wild harvesting of edible and medicinal plants by local people poses important threats to the flora of Hashtad Mountain. One of the most impacted species is *Allium stipitatum* (Mousir in Persian), which is heavily harvested for its bulbs. This intensive harvesting significantly reduces the population size in this area. Furthermore, some Lamiaceae species, such as *Thymus* spp., *Stachys* spp., and *Ziziphora* spp., are collected for culinary uses. Most other species are primarily harvested for their medicinal properties. The most commonly harvested species for their edible and medicinal uses include: *Allium stipitatum*, *Artemisia haussknechtii*, *Ferula assa-foetida*, *Ferulago angulata*, *Echinophora sibthorpiana*, *Eryngium billardieri*, *Dorema aucheri*, *Ixiolirion tataricum*, *Prangos ferulacea*, *Thymus daenensis*, *Tanacetum kotschyi*, *Scutellaria multicaulis*, *Nepeta sessilifolia*, *Thymus carmanicus*, and *Ziziphora clinopodioides*.

Endangered species and threat factors

Most endemic species in the Zagros region, including those on Hashtad Mountain, are critically endangered due to various factors such as limited Area of Occupancy (AOO), Extent of Occurrence (EOO), small population sizes, poor habitat quality, and issues with natural regeneration. Human activities, including overgrazing and habitat degradation, have further aggravated these conditions, leading to a decline in mature individuals and the deterioration of their natural habitats. Our field observations in Hashtad Mountain and other parts of Isfahan Province have identified several primary threats to plant species in the region. Global warming and prolonged droughts, driven by climate change, have reduced water availability and disrupted natural growing seasons, posing a serious risk to water-dependent species and upsetting the balance of the ecosystem. Additionally, human interference through land-use changes, such as converting pastures into agricultural land, has resulted in biodiversity loss as natural habitats are replaced by human-dominated landscapes. Infrastructure development, mainly road construction and mining for stone extraction, has destroyed and fragmented habitats, displacing plant species and degrading their environments. Overgrazing by livestock, which exceeds the carrying capacity of the rangelands, remains a critical threat, leading to severe degradation of plant communities, soil erosion, and increased vulnerability to invasive species.

DISCUSSION

The floristic study of Hashtad Mountain highlights a remarkable diversity of plant species, largely due to the mountain's complex topography and unique climatic conditions. When comparing the species diversity of Hashtad Mountain with other high-altitude regions in Iran, it is evident that these regions exhibit a similar level of species diversity. However, a more meaningful comparison arises when examining the similarities within key families and genera rather than focusing solely on species count. For instance, the genus *Astragalus* plays a significant role across several mountainous regions, including Hashtad Mountain, where it constitutes a significant portion of the flora. *Astragalus* is the largest genus in Iran's flora, with over 850 species, of which approximately 65% are endemic (Maassoumi 2005; Akhavan & al. 2019). On Hashtad Mountain, *Astragalus* accounts for over 80% of the Fabaceae family, with 21 out of the total 26 species belonging to this genus, reflecting patterns observed in regions like Hezar and Alvand Mountains (Rajaei & al. 2011; Dehshiri & al. 2016). Of the 26 *Astragalus* species found in this area, 13 are endemic to Iran, emphasizing the mountain's favorable conditions for the genus's diversity (Bagheri & al. 2017). In Hezar Mountain, which hosts 208 species, the most dominant families are Asteraceae, Fabaceae, and Lamiaceae, similar to their importance on Hashtad Mountain. The presence of genera such as *Astragalus* and *Nepeta* in both regions indicates ecological parallels that support the growth of these plants. Meanwhile, in Oshtorankuh, Asteraceae and Fabaceae are among the most significant families, highlighting their importance in Iran's alpine regions (Dehshiri & Mahdavar 2016). Therefore, when comparing key families and genera like *Astragalus* and Fabaceae across these regions, Hashtad Mountain reveals deeper ecological similarities. These parallels highlight the mountain's crucial role in contributing to biodiversity and preserving endemic species in Iran's alpine zones.

The life form of plants is indicative of their adaptation to environmental conditions. The spectrum of life forms observed in the region indicates the presence of alpine vegetation, with hemicryptophytes representing the most abundant life form and phanerophytes the least abundant. This observation is consistent with the findings of the present study Archibold (1995) posits that the prevalence of hemicryptophytes in the region is indicative of a cold and mountainous climate. Conversely, in foothill areas and lower elevations, the percentage of phanerophytes increases, while hemicryptophytes decrease. This distribution of life forms highlights the ecological conditions of the alpine and sub-alpine zones of Hashtad Mountain.

Mountainous regions are known for their diverse habitats and extreme climatic conditions, which support numerous unique plant species. These species make the mountains particularly significant from a biodiversity standpoint. Despite the natural protection offered by their isolation and harsh conditions, these areas face a multitude of threats. Overgrazing, wild harvesting of edible and medicinal plants by local communities, and the utilization of underground resources, such as mining and road construction, are among the most significant threats to these regions. Field observations indicated that mining, road construction, and overgrazing were the most significant threats to the plant species in the study area. Figure 7 demonstrates the extent of mining and road construction activities in the region, highlighting the environmental pressures on the local flora. These human activities exacerbate the vulnerability of the unique plant species and their habitats.

Fig. 7. Mining and road construction activities in the Hashtad Mountain region, illustrating the environmental pressures on the local flora.

The findings highlight the necessity for focused conservation to preserve the biodiversity of the region. To preserve the biodiversity of Hashtad Mountain, immediate conservation measures such as establishing protected areas and regulating human activities are essential. Future research should focus on continuous monitoring of these ecosystems and developing sustainable management strategies to ensure the long-term protection of this unique natural heritage.

While there have been some floristic studies in Iran's high mountains, comprehensive research remains limited due to the challenging access to these areas. This study addresses this gap by providing detailed information on the endemic and endangered species in the Hashtad Mountain area, which will be valuable for future research and conservation efforts.

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Table 1. List of plant species collected in Hashtad Mountain, including their families, life forms, chorotypes, voucher specimens in SFAHAN herbarium, and habitat types.
Iranian endemics are marked by a single asterisk (*) and Zagros endemics are marked by a double asterisk (**).
Habitat types are indicated as follows: Rocky Slopes (RS), Thorn-Cushion (TC), Tall Herbs and Umbelliferous (TU), and Mountain Steppe (MS).

No.	Taxon	Life form	Chorotype	Habitat types	Voucher specimens
	Alliaceae				
1	*Allium austroiranicum* R.M.Fritsch*	Ge	IT	MS, RS	18247
2	*Allium longivaginatum* Wendelbo*	Ge	IT	RS	18322
3	*Allium minutiflorum* Regel*	Ge	IT	MS	18333
4	*Allium stipitatum* Regel	Ge	IT, ES	RS, TH	18334
5	*Allium ubipetrense* R.M.Fritsch*	Ge	IT	MS, RS	18335
	Apiaceae				
6	*Astrodaucus persicus* (Boiss.) Drude*	He	IT	TU	18286
7	*Bunium caroides* (Boiss.) Hausskn. ex Bornm	Ge	IT	MS	18257
8	*Dorema aucheri* Boiss.*	He	IT	TU	18336
9	*Echinophora sibthorpiana* Guss.	He	IT, ES	MS	1291
10	*Eryngium billardieri* F. Delaroche	He	IT, ES	TU	18292
11	*Ferula assa-foetida* L.*	He	IT	TU	18337
12	*Ferula haussknechtii* H.Wolff ex Rech.f.	He	IT	TU	18338
13	*Ferulago angulata* (Schltdl.) Boiss.	He	IT	TU	18339
14	*Ferulago contracta* Boiss. &Hausskn.*	He	IT	TU	18182
15	*Leutea petiolaris* (DC.) M. Pimen.*	He	IT	TU	18340
16	*Pimpinella kotschyana* Boiss.	He	IT, ES, M	MS	18341
17	*Pimpinella tragium* Vill.	He	IT, ES, M	MS	18216
18	*Prangos ferulacea* (L.) Lindl.	He	IT, M	TU	18236
19	*Prangos uloptera* DC.	He	IT	TU	18226
20	*Rhabdosciadium straussii* Hausskn. ex Bornm.*	He	IT	TU	18342
21	*Smyrniopsis aucheri* Boiss.	He	IT	TU	18233
22	*Zeravschania aucheri* (Boiss.) M. Pimen.*	He	IT	TU	18264
	Asphodelaceae				
23	*Eremurus persicus* (Jaub. & Spach) Boiss.	Ge	IT	TU	18343
24	*Eremurus spectabilis* M.B.	Ge	IT, ES	TU	18207
	Asteraceae				
25	*Anthemis lorestanica* Iranshahr**	Th	IT	MS	18222
26	*Artemisia haussknechtii* Boiss.	He	IT	RS	18265
27	*Artemisia persica* Boiss.	Ch	IT	MS	18268
28	*Centaurea aucheri* (DC.) Wagenitz	He	IT	MS	1255
29	*Centaurea luristanica* Rech.f.**	He	IT	MS	18232
30	*Cirsium bracteosum* DC.	He	IT	TU	18270

31	*Cousinia bachtiarica* Boiss. & Hausskn.**	He	IT	MS	18344
32	*Cousinia multiloba* DC.	He	IT	MS	18272
33	*Echinops ritrodes* Bunge	He	IT	MS	18278
34	*Helichrysum oligocephalum* DC.*	Ch	IT	MS	18295
35	*Iranecio paucilobus* (DC.) B.Nord.	He	IT	TU	18258
36	*Jurinea eriobasis* DC.*	He	IT	MS	18345
37	*Jurinea meda* Bornm.**	He	IT	MS, RS	18279
38	*Jurinea prasinophylla* Rech.f.**	He	IT	MS	1307
39	*Lactuca polyclada* Boiss.*	He	IT	MS	18346
40	*Lactuca serriola* L.	He	Mult	TU	18213
41	*Pentanema multicaule* Boiss.*	He	IT	MS	18267
42	*Phagnalon persicum* Boiss.*	He	IT	RS	18194
43	*Psychrogeton amorphoglossus* (Boiss.) Novopokr.	He	IT	RS	18214
44	*Scariola orientalis* (Boiss.) Soják	He	IT	MS	18261
45	*Scorzonera ramosissima* DC.	He	IT	MS	18290
46	*Serratula latifolia* Boiss.	He	IT	TU	18282
47	*Tanacetum kotschyi* (Boiss.) Grierson	He	IT	RS	18187
48	*Tanacetum persicum* (Boiss.) Mozaffarian	He	IT	RS	18347
49	*Tanacetum polycephalum* Schultz-Bip.	He	IT	MS	18193
50	*Tragopogon bakhtiaricus* Rech.f.**	He	IT	MS	18254
51	*Tragopogon vvedenskyi* M. Pop. Ex. Pavlov	He	IT	MS	18308
	Boraginaceaea				
52	*Arnebia euchroma* (Royle) Johnst.	He	IT	MS	18348
53	*Lappula sessiliflora* (Boiss.) Gürke	Th	IT	MS	18318
54	*Nonea persica* Boiss.	He	IT	MS	18319
55	*Onosma kotschyi* Boiss.*	He	IT	MS	18252
56	*Solenanthus circinnatus* Ledeb.	He	IT	TU, MS	18298
	Brassicaceae				
57	*Aethionema stenopterum* Boiss.	He	IT, ES	MS	1327
58	*Aethionema fimbriatum* Boiss.	He	IT, ES	MS	18217
59	*Alyssum bracteatum* Boiss. & Bushe	He	IT	MS	18241
60	*Alyssum szovitsianum* Fisch. & C.A.Mey.	Th	IT, ES	MS	18208
61	*Aubrieta parviflora* Boiss.	He	IT	RS	18249
62	*Chalcanthus renifolius* (Boiss. & Hohen.) Boiss.	He	IT	MS	18289
63	*Conringia perfoliata* (C.A.Mey.) N.Busch	Th	IT, ES, M	MS	18349
64	*Fibigia macrocarpa* (Boiss.) Boiss.	He	IT	TU	18350
65	*Fibigia suffruticosa* (Vent.) Sweet	He	IT	MS	18221
66	*Graellsia saxifragifolia* (DC.) Boiss.	He	IT	RS	1288
67	*Lepidium buschianum* Al-Shehbaz*	He	IT	MS	18205

68	*Matthiola chenopodiifolia* Fisch. & C.A.Mey.	Th	IT	MS	18351
69	*Matthiola flavida* Boiss.	He	IT	MS	18210
70	*Noccaea perfoliata* (L.) Al-shahbaz	Th	IT, ES, SS	MS	18197
71	*Peltaria angustifolia* DC.	Th	IT	MS	18243
72	*Physoptychis gnaphalodes* (DC.) Boiss.	He	IT, ES	MS	18215
	Campanulaceae				
73	*Asyneuma persicum* (A.DC.) Bornm.	He	IT	TU	18212
74	*Asyneuma virgatum* (Labill.) Bornm.	He	IT, ES	TU	18198
	Caryophyllaceae				
75	*Arenaria persica* Boiss.**	Ch	IT	RS	18181
76	*Cerastium dichotomum* L.	Th	Mult	MS	18238
77	*Cerastium inflatum* Link ex Desf.	Th	IT, ES	MS	18352
78	*Dianthus orientalis* Adams	He	IT	TC	18285
79	*Gypsophila pallida* Stapf	He	IT	MS	18353
80	*Gypsophila polyclada* Fenzl ex Boiss.	He	IT	MS	18354
81	*Gypsophila virgata* Boiss.*	Ch	IT	MS	18269
82	*Mesostemma kotschyanum* (Fenzl ex Boiss.) Vved.	He	IT	MS	18296
83	*Minuartia lineata* Bornm.	He	IT	MS	18209
84	*Silene aucheriana* Boiss.	He	IT, ES	MS	18231
85	*Silene chlorifolia* SM.	He	IT, ES	MS	18196
86	*Silene microphylla* Boiss.*	He	IT	MS	1298
	Chenopodiaceae				
87	*Chenopodium foliosum* Asch.	Th	IT	MS	1256
88	*Noaea mucronata* (Forssk.) Asch. & Schweinf.	Ch	IT, ES, M	RS	18262
	Colchicaceae				
89	*Colchicum kotschyi* Boiss.	Ge	IT,ES	MS	18302
	Convolvulaceae				
90	*Convolvulus urosepalus* Pau.**	Ch	IT	MS	18190
	Crassulaceae				
91	*Pseudosedum multicaule* (Boiss. & Buhse) Boriss.	He	IT	RS	18204
92	*Rosularia elymaitica* (Boiss. & Hausskn.) Berger	He	IT, ES	RS	18355
	Cyperaceae				
93	*Carex microglochin* Wahlenb	Ge	Mult	MS	18330
94	*Carex stenophylla* Wahlenb	Ge	IT, ES, M	MS	18306
95	*Eleocharis uniglumis* (Link) Schult.	He	Cosm	MS	18331
	Dipsacaceae				
96	*Cephalaria microcephala* Boiss.	He	IT, ES	TU	1258
97	*Cephalaria hirsuta* Stapf	He	IT	TU	18200
98	*Pterocephalus canus* Coult. ex DC.	He	IT	TU	18297

	Euphorbiaceae				
99	*Euphorbia aucheri* Boiss.	He	IT	MS	18276
100	*Euphorbia cheiradenia* Boiss. & Hohen.	He	IT	MS	1317
101	*Euphorbia polycaulis* Boiss. &Hohen.*	He	IT	MS	18356
102	*Euphorbia hebecarpa* Boiss.*	He	IT	MS	18277
103	*Euphorbia virgata* Waldst. & Kit.	He	IT, ES, M	MS	18288
	Fabaceae				
104	*Astragalus aegobromus* Boiss. & Hohen.	He	IT	MS	18320
105	*Astragalus andalanicus* Boiss. & Hausskn.	Ch	IT	TC	18357
106	*Astragalus apricus* Bunge	He	IT	MC	18358
107	*Astragalus brachycalyx* Fisch.	Ch	IT	TC	18359
108	*Astragalus chartostegius* Boiss. & Hausskn.*	Ch	IT	TC	18360
109	*Astragalus chrysotrichus* Boiss.**	He	IT	MS	18323
110	*Astragalus curvirostris* Boiss.*	He	IT, ES, SS	MS	18305
111	*Astragalus cyclophyllon* Beck*	He	IT	MS	18361
112	*Astragalus inexpectatus* Maassoumi & Podlech**	He	IT	MS	18362
113	*Astragalus johannis* Boiss.**	Ch	IT	MS	18363
114	*Astragalus kirrindicus* Boiss. & Noe	He	IT	MS	18283
115	*Astragalus lignipes* Akhavan & Maassoumi**	He	IT	MS	18325
116	*Astragalus macrourus* Hohen.*	He	IT	MS	18316
117	*Astragalus microphysa* Boiss.**	Ch	IT	TC	18195
118	*Astragalus multijugus* DC.*	He	IT	MS	18242
119	*Astragalus murinus* Boiss.**	Ch	IT	TC	1290
120	*Astragalus patrius* Maassoumi*	He	IT, ES	MS	18324
121	*Astragalus ptychophyllus* Boiss.**	Th	IT	TC	18364
122	*Astragalus rhodosemius* Boiss. & Hausskn.*	Ch	IT	TC	18365
123	*Astragalus susianus* Boiss.**	Ch	IT	TC	18366
124	*Astragalus verus* Olivier	Ch	IT	TC	18367
125	*Coronilla varia* L.	He	IT, ES, M	TU	18199
126	*Onobrychis cornuta* (L.) Desv.	Ch	IT, ES	TC	18189
127	*Ononis spinosa* L.	He	IT, ES, M	MS	1257
128	*Oxytropis chrysocarpa* Boiss.*	He	IT	MS	18311
129	*Vicia ciceroidea* Boiss.	He	IT, ES	MS	18203
	Geraniaceae				
130	*Biebersteinia multifida* DC.	Ge	IT	MS	18368
131	*Erodium cicutarium* (L.) L'Hér.	Th	IT, ES, M	MS	18245
132	*Geranium rotundifolium* L.	Th	IT, ES, M	MS	18255
133	*Geranium tuberosum* L.	Ge	IT, ES, M	MS	18218

	Hyacinthaceae				
134	*Bellevalia* sp.	Ge	-	MS	18369
135	*Muscari neglectum* Guss. ex Ten.	Ge	IT, ES, M	MS	18300
136	*Ornithogalum orthophyllum* Ten.	Ge	Mult	MS	18370
	Ixioliriaceae				
137	*Ixiolirion tataricum* (Pall.) Herb.	Ge	Mult	MS	18371
	Lamiaceae				
138	*Lallemantia royleana* (Benth. in wall.) Benth. In DC.	Th	IT, ES	MS	18372
139	*Lamium amplexicaule* L.	Th	IT, ES, M	MS	18240
140	*Marrubium astracanicum* Jacq.	He	IT, ES	MS	18201
141	*Nepeta laxiflora* Benth. in DC.**	He	IT	RS	18373
142	*Nepeta sessilifolia* Bunge*	He	IT	RS	18281
143	*Phlomis anisodonta* Boiss.*	He	IT	MS	18271
144	*Phlomis olivieri* Benth.	Ch	IT	MS	18260
145	*Salvia atropatana* Bunge	He	IT	MS	18287
146	*Salvia hydrangea* DC. ex Benth.	He	IT, M	MS	18223
147	*Salvia reuterana* Boiss.	He	IT	MS	18225
148	*Scutellaria multicaulis* Boiss.*	He	IT	MS	18259
149	*Scutellaria nepetifolia* Benth.in DC.*	He	IT	MS	18374
150	*Stachys acerosa* Boiss.*	Ch	IT	TC	18246
151	*Stachys aucheri* Benth.in DC.**	Ch	IT	MS	1325
152	*Stachys benthamiana* Boiss.*	He	IT	MS	18224
153	*Stachys lavandulifolia* Vahl	He	IT, ES	MS	18251
154	*Stachys pilifera* Benth. in DC.**	He	IT	MS	18244
155	*Thymus carmanicus* Jalas	Ch	IT	MS, RS	18180
156	*Thymus daenensis* Celak.*	He	IT	MS	18184
157	*Ziziphora clinopodioides* Lam.	Ch	IT, ES	MS	18266
	Liliaceae				
158	*Fritillaria imperialis* L.	Ge	IT	TU	18309
159	*Fritillaria persica* L.	Ge	IT	MS	18310
160	*Gagea gageoides* (Zucc.) Vved.	Ge	IT, ES	MS	18375
161	*Tulipa stylosa* Fisch.	Ge	IT	MS	18312
	Orobanchaceae				
162	*Orobanche aegyptiaca* Pers.	Th	IT, ES, M	MS	18327
	Papaveraceae				
163	*Papaver armeniacum* (L.) DC.	Th	IT	MS	1269
	Plumbaginaceae				
164	*Acantholimon aspadanum* Bunge**	Ch	IT	TC	18376
165	*Acantholimon hohenackeri* (Jaub. & Spach) Boiss.	Ch	IT	TC	18377

	Poaceae				
166	*Arrhenatherum kotschyi* Boiss.	Ge	IT	MS	18378
167	*Bromus danthoniae* Trin.	Th	IT	MS	1813
168	*Bromus tectorum* L.	Th	Cosm	MS	18228
169	*Bromus tomentellus* Boiss.	He	IT, ES, M	MS	18186
170	*Dactylis glomerata* L.	He	Cosm	MS	18280
171	*Elymus hispidus* (Opiz) Melderis	He	Mult	MS	18299
172	*Piptatherum holciforme* (M.Bieb.) Hack	He	IT, M	MS	1300
173	*Poa bulbosa* L.	Ge	Mult	MS	18229
174	*Psathyrostachys fragilis* (Boiss.) Nevski	Ge	IT	MS	18294
175	*Stipa arabica* Trin. & Rupr.	He	IT	MS	1308
176	*Taeniatherum caput-medusae* (L.) Nevski	Th	Mult	MS	18220
	Podophyllaceae				
177	*Leontice leontopetalum* L.	Ge	IT, M, SS	MS	18301
	Primulaceae				
178	*Dionysia bazoftica* Jamzad**	Ch	IT	RS	18379
	Ranunculaceae				
179	*Ceratocephala falcata* (L.) Pers.	Th	IT, ES, M	MS	18315
180	*Delphinium saniculifolium* Boiss.*	He	IT	TU	18211
181	*Ficaria kochii* (Ledeb.) Iranshahr & Rech.f.	Ge	IT	MS	18313
182	*Ranunculus aucheri* Boiss.	Th	IT, M	MS	18304
183	*Ranunculus macropodoides* Briq.	He	IT	MS	18239
184	*Thalictrum isopyroides* C.A. Mey.	He	IT, ES	MS, TU	18227
	Rhamnaceae				
185	*Rhamnus cornifolia* Boiss. & Hohen.	Ch	IT	RS	18183
186	*Rhamnus persica* Boiss.	Ph	IT	RS	6429
	Rosaceae				
187	*Amygdalus haussknechtii* (C.K.Schneid.) Bornm.*	Ph	IT	RS	18380
188	*Cerasus brachypetala* Boiss.	Ph	IT	RS	18250
189	*Cerasus microcarpa* (C.A.Mey.) Boiss.	Ph	IT	RS	1294
190	*Cotoneaster persicus* Pojark.*	Ph	IT	RS	18230
191	*Rosa elymaitica* Boiss. & Hausskn.	Ph	IT, ES	RS	18293
192	*Rosa pulverulenta* M.B.	Ph	IT, ES, M	RS	1283
	Rubiaceae				
193	*Asperula brachyantha* Boiss.*	Ch	IT	MS	18291
194	*Asperula glomerata* (M.Bieb.) Griseb.	Ch	IT	MS	18191
195	*Cruciata taurica* (Pall. ex Willd.) Ehrend.	He	IT, ES, M	MS	18234
196	*Rubia albicaulis* Boiss.*	Ch	IT	MS	18185

		Santalaceae			
197	*Thesium kotschyanum* Boiss.	Th	IT, SS	MS	18253
		Scrophulariaceae			
198	*Bungea trifida* (Vahl) C.A.Mey.	He	IT, ES	MS	18192
199	*Linaria fastigiata* Chav.	He	IT	MS	1259
200	*Linaria pyramidalis* (Vent.) F.G. Dietr.	He	IT, ES	MS, TU	18381
201	*Odontites aucheri* Boiss.	Th	IT, ES	MS	18275
202	*Scrophularia nervosa* Benth.	He	IT	MS	1814
203	*Scrophularia sanguinea* Grau	He	IT	MS	18274
204	*Scrophularia variegate* M.B	He	IT, ES	MS	18273
205	*Verbascum speciosum* Schrad.	He	IT, ES	TU	18382
206	*Veronica orientalis* Mill.	He	IT, ES, M	MS	18237
		Solanaceae			
207	*Hyoscyamus niger* L.	He	Mult	MS	18303
		Thymeleaceae			
208	*Daphne mucronata* Royle	Ph	IT, SS	RS	18284
		Urticaceae			
209	*Parietaria judaica* L.	Ch	Mult	RS	18256
		Valerianaceae			
210	*Valeriana sisymbrifolia* Vahl	He	IT	RS	18188
		Violaceae			
211	*Viola pachyrhiza*Boiss. et Hohen	He	IT	MS	18317
		Woodsiaceae			
212	*Cystopteris fragilis (L.) Bernh.*	He	Cosm	RS	18326