مطالعه گیاگانی پوشش گیاهی منطقه حفاظت شده پلنگ گالون در استان اصفهان، ایران

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دریافت: ۱۳۹۳/۰۷/۱۲ / ویرایش: ۱۳۹۴/۰۶/۱۵ / پذیرش: ۱۳۹۴/۰۷/۰۶ / انتشار: ۱۳۹۷/۰۹/۳۰

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چکیده. منطقه حفاظت‌شدهٔ پلنگ گالون با مساحتی بالغ بر ۳۴۹۳۵ هکتار در ۷۵ کیلومتری شمال غرب نجف آباد، و ۱۰۲ کیلومتری شمال غرب اصفهان واقع شده است. هدف از این تحقیق بررسی طیف گیاگانی، گسترهٔ اشکال زیستی، تحلیل پراکنش جغرافیایی، تعیین وضعیت حفاظتی، گیاهان دارویی، مرتعی و سمی این ذخیره‌گاه است. نمونه‌های گیاهی طی فصول مختلف رویشی و در چندین مرحله جمع‌آوری شدند. اشکال زیستی نمونه‌ها و تحلیل پراکنش جغرافیایی تعیین شدند. براساس نتایج حاصل از این تحقیق، ۱۶۶ گونه، ۱۲۶ سرده و ۳۹ تیره در این منطقه شناسایی شدند. ۶ تیره، ۲۳ سرده و ۲۶ گونه متعلق به تک‌لپه‌ای‌ها و ۳۳ تیره، ۱۰۳ سرده و ۱۴۰ گونه متعلق به دولپه‌ای‌ها هستند. بر پایهٔ تحلیل پراکنش جغرافیایی، ۵۸ درصد از گونه‌های گیاهی در ناحیه ایران و تورانی گسترش دارند. شایان ذکر است که در این منطقه ۴۴ گونهٔ انحصاری، ۹۷ گونهٔ دارویی، ۴۸ گونهٔ مرتعی و ۲۳ گونهٔ سمی مشخص شده است. اشکال زیستی شامل ۵۴ درصد همی کریپتوفیت، ۲۴ درصد تروفیت، ۱۰ درصد ژئوفیت، ۷ درصد کامه‌فیت و ۵ درصد فانروفیت هستند. براساس معیارهای گونه‌های مورد تهدید، ۲۲ گونهٔ در خطر کمتر و ۷ گونهٔ آسیب پذیر هستند.

واژه‌های کلیدی. انحصاری، ایران وتورانی، پراکنش جغرافیایی، دارویی، ذخایر طبیعی

Floristic study of vegetation in Palang Galoun protected region, Isfahan province, Iran

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Received: 04.10.2014 / Revised: 06.09.2015 / Accepted: 28.09.2015 / Published:21.12.2018

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Abstract. The Palang Galoun protected region, comprising 34935 hectares, is located 75 km northwest of Najaf Abad, and 102 km northwest of Isfahan city. The aim of this research was to assess the floristic spectrum, life form varieties, chorological analysis, determination of protected status and identification of medicinal, threatened species criteria and poisonous plants of this natural heritage. Plant samples were collected during different vegetative seasons at several stages. Life forms of samples were determined and chorological analysis was performed. On the basis of the obtained results, a total of 166 species belonging to 126 genera and 39 families were identified. Six families, 23 genera and 26 species belonged to monocotyledons, whereas 33 families, 103 genera and 140 species belonged to dicotyledons. In terms of chorological analysis, 58% of plant species were distributed in the Irano-Turanian region. It is noteworthy that 44 endemic species, 97 medicinal species, 48 pasture species and 23 poisonous species were present in the studied area. Life forms were found to comprise 54% hemicryptophytes, 24% therophytes, 10% geophytes, 7% chamaephytes and 5% phanerophytes. Based on IUCN red list categories and criteria, there were 22 species in the lower risk category and seven species categorized as vulnerable case.

Keywords. endemic, geographical distribution, Irano-Turanian, medicinal, natural resources

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INTRODUCTION

Iran, with a highly diverse climate and abundant plant genetic resources, is one of the richest countries in the world in terms of plant diversity. Different climatic conditions and height variations result in different plant accessions together with different species combinations in the Iranian Plateau (Yousefi, 2006). It is reported that the flora of Iran includes 42 orders, 139 families, nearly 1252 genera and 8100 species of angiosperms (Ghahremaninejad *et al*., 2017). Plant vegetation has an important role in the regulation of water levels, soil protection and suppression of soil erosion (Mesdaghi, 2005). The evaluation and study of floristic regions, including floristic schedules, physiognomy and chorology of species, are instrumental in the management of natural resources, determination of plant diversity, the identification of medicinal, industrial, poisonous, and pasture plants and eventually rangeland restoration (Yousefi, 2006). Due to several impacts on the survival, dispersal and life continuity of plant species, and presumably their extinction, it is necessary to categorize plant species and protect them. Consequently, recognition of plant vegetation in an area is definitely of value (Chytry, 2000).

Isfahan Province, with an area of 105000 km^2, is located within latitudes 31º 45′ and 34º 30′N, and altitudes 45º 9′ and 55º 15′E. This province stands in the central Zagros region and exhibits a wide range of dry climate. The common factors contribute to different climates include height variation, water sources, geographical latitude, plant vegetation, agriculture and industry (Alinia Ahandani *et al.*, 2010). Isfahan Province has dramatic plant diversity which has been partially studied using floristic methods in Vanak-e Semirom, Badroud-e Natanz, different locations in Chadegan, Fereydounshahr, Karkas Mountains, Ghaza-an Kashan, Kolah Ghazi, Mouteh, Ghamishlou and Hanna protected regions (Aryavand, 2001; Batouli, 2003; Yousefi, 2006; Parishni, 2005; Yousefi *et al.*, 2011; Abbasi *et al.*, 2012; Abdi & Afsharzadeh, 2012; Khajedin & Yeganeh, 2010, 2012). A total of 2000 species were identified in different areas of this province in the forms of shrub, herbaceous, fruticose and tree (Alinia Ahandani *et al.*, 2010). As mentioned above, the presence of high species number in several vegetation areas of Isfahan Province has been detected to be due to vegetation diversity (Yousefi *et al.*, 2011). More precipitation in the western region of the province resulted in the presence of more floristic elements which were recorded in different protected areas (Aryavand, 2001; Parishani, 2005; Yousefi, 2006; Yousefi *et al.*, 2011). Moreover, Raunkiaer's life forms with various percentages were identified. Life form spectra represent the adaptation to climatic conditions and genetic fundamentals (Asri, 1999). Certain ecological changes will endure in environmental conditions. Therefore, vegetation feature is one of the important phenomena in nature which can be used to distinguish ecological factors (Basiri *et al.*, 2011).

The sustainability of a vegetative region is mainly concerned with the increase in the number of species and the resistance to extinction of floristic elements which preserve the valuable genetic heritage (Basiri *et al.*, 2011). In addition, most of the geographical distributions of different floristic regions were found to be mono-regional, bi-regional or pluri-regional (Batouli, 2003; Mesdaghi, 2005; Abdi & Afsharzadeh, 2012).

Based on the findings of IUCN (International Union for Conservation of Nature), various percentages of vulnerable and endangered species were also identified in different areas of Isfahan Province (Yousefi *et al.*, 2011; Abdi & Afsharzadeh, 2012; Khajedin & Yeganeh, 2012). This has the potential to lead to a new approach to the conservation of genetic resources. Since there is no report from the Palang Galoun protected region (hunting prohibited), the floristic assessments were investigated in this research. Therefore, the purposes of this research are as follows, 1) the identification and accurate determination of the floristic elements, especially those of endemic, medicinal, pasture and poisonous plants, 2) determination of the life forms spectra and 3) determination of the geographical distribution (chorotype) of the species.

MATERIALS AND METHODS

Identification of the studied area The protected region of Palang Galoun, comprising an area of 34935 hectares, is geographically located at longitude 50º 47' E and latitude 33º 1' N at 102 km from Isfahan city and 75 km northwest of Najaf Abad, Mehrdasht section. It is adjacent to mountainous areas including the Deghouzi mountains and Lotus region to the north, the Zahir Mountains to the east and Kheyrabad to the northwest (Fig. 1). Other areas next to the studied region include Asgaran and Dolatabad Karvan to the south, and Karvan to the southwest. The altitude of the studied area ranges as from 2500-3100 m above

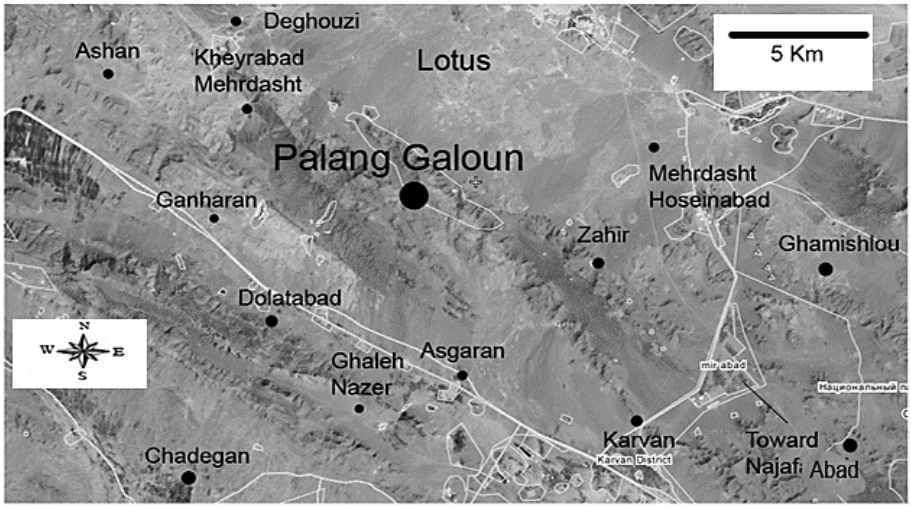


Fig. 1. The geographical position of Palang Galoun protected region in Isfahan province.

sea level. In terms of climate coefficient, we attempted to apply De Martonne aridity index (1926) to identify the climate classification. The aridity Index (I=P/T+10) was estimated where P= annual precipitation and T= annual mean temperature. The De Martonne aridity index decreases with the increase of aridity. While there is no detailed research about the geological features of this area, the geological studies from adjacent areas were summarized: The metalogenic belts were reported from Dare-bid (the south of Palang Galoun) which is located on several fault lines. The faults have fluid mineralizing shale from lower Jurassic and Cretaceous limestone. Zinc reserves in the lower Cretaceous sediments have also been reported. Dolomitic rocks are observed with elements such as magnesium and silicon as well as deposits of zinc carbonate and iron oxide. In the Ganharan zone, limestone and calcareous shale were reported. The soil studies and regional assessments of Najaf Abad showed that zone formations were mainly covered with Jurassic and Cretaceous limestone (Rezaei *et al.*, 2011; Shamsi & Amini, 2011).

Research method

The specimen collection from the protected region and its evaluation were carried out using geographical maps and field visits. The samples were collected during all of the vegetative sessions at several stages mainly from March 2013 till June 2015. In order to identify and determine the collected samples, such reliable references as Flora Iranica (Rechinger, 1963-2005), Flora of Iran (Assadi *et al.*, 1989-2017), vegetation of Iran (Mobayen, 1975-1996), Flora of Turkey (Davis, 1965-1988) and Plant Taxonomy (Mozaffarian, 2005) were used. The herbarium specimens were compared with the herbarium sheet of Isfahan University and Agricultural Research Center of Isfahan. All the specimens were deposited in the Herbarium of Shahrekord and Isfahan Universities. The life form of each collected sample was determined using Raunkiaer's method (1934). Moreover, the chorological distribution of the species studied was identified using Zohary (1973) and Flora of Iran (Assadi *et al.*, 1989-2017). Defining the conservation status of species studied was performed on the basis of the Red Data Book (Jalili & Jamzad, 1999). In addition, the medicinal, pasture and poisonous properties of each species were studied using reliable references (Asri, 2011, 2012; Mozaffarian, 2015).The graphical interpretations of the obtained floristic, life form and chorological data were executed by means of Microsoft Excel (2013). The climatic condition of Najaf Abad region is characterized by low precipitation during the five months of spring-summer. Based on the data obtained from the Meteorological station at Najaf Abad, a climatic diagram covering the years 2002-2015 was created (Fig. 2).

According to Najaf Abad Meteorology Agency, the mean annual temperature, mean minimum and mean maximum temperatures were 15.2 °C, 7.3 °C and 23.1 °C, respectively. Absolute minimum and maximum temperatures were -18.5 °C and 42.5°C. The mean annual precipitation in winter was 150.09 mm. The maximum 24- hour rainfall was 52.5 mm and the average number of frost days was 88 days per year. De Martonne's (1926) method has been applied and the aridity Index for Najaf Abad was found to be 19.99. This revealed that the type of climate could be classified as semiarid.

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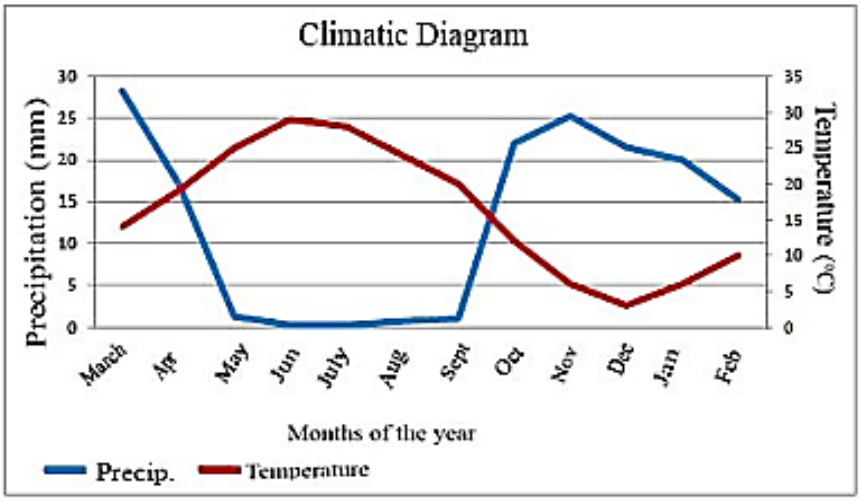


Fig. 2. Climatic diagram from Meteorological station from Najaf Abad covering the years 2002-2015.

RESULTS AND DISCUSSION

The results of floristic study showed that a total of 171 specimens were collected during 2013-2015 at heights ranging from 2565 to 2776 m. Moreover, 166 species, 126 genera and 39 families were identified. A total of 6 families, 23 genera and 26 species belonged to monocots, while 33 families, 103 genera and 140 species belonged to dicotyledons (Appendix I).

The most common angiosperm families are represented by Asteraceae (16 genera, 22 species), Lamiaceae (12 genera, 19 species), Brassicaceae (15 genera, 15 species), Poaceae (14 genera, 15 species), Fabaceae (7 genera, 14 species), Caryophyllaceae (8 genera, 10 species) and Scrophulariaceae (4 genera, 9 species) (Appendix I, Fig. 3A). *Astragalus* L. (8 species) and *Veronica* L. (5 species) have been the most prominent genera, and other genera such as *Nepeta* L., *Stachys* L. and *Centaurea* L. (4 species) come after (Appendix I, Fig. 3B). A total of 108 genera have only one species in the region, and 13 genera with two species were also determined. Other genera were characterized by more than two species (Appendix I). The genera with only one species were abundant in Brassicaceae (15 genera, 17%), Poaceae (13 genera, 15%), Asteraceae (10 genera, 11%) and Lamiaceae (9 genera, 10%) (Appendix I, Fig. 3C). 21 subspecies and 11 varieties were identified in this area (Appendix I). Asteraceae, Fabaceae and Brassicaceae families constituted the highest numbers of subspecies. Moreover, the highest number of varieties was found in Poaceae (Appendix I, Fig. 3D). It should be noted that 7 species were reported from the Isfahan Province for the first time. There was one new infra-specific rank belonging to Asteraceae which was also reported for the first time in Iran.

The life forms in the studied area included a high proportion of hemicryptophyte (54%), therophyte (24%) and geophyte (10%). Other life forms such as chamaephyte and phanerophyte constituted 5-7% (Fig. 4A). The most dominant hemicryptophytes were observed in Asteraceae (17 species), Lamiaceae (13 species), Fabaceae (9 species), Brassicaceae and Poaceae (8 species), Apiaceae (6 species) and Caryophyllaceae (4 species). Correspondingly, the most dominant therophytes belonged to Scrophulariaceae (6 species), Brassicaceae (6 species), Poaceae (5 species) and Asteraceae (4 species). The geophytes were represented by Liliaceae (4 species), Poaceae and Cyperaceae (2 species). The floristic elements chorology showed that most of the chorotypes were mainly associated with the Irano-Turanian (58%) and Irano-Turanian/Euro-Siberian (10%) regions. The remainder of the elements were Irano-Turanian/ Mediterranean (8%), Irano-Turanian/ Mediterranean/ Euro-Siberian (7%), Irano-Turanian/ Saharo-Sindian (4%), Pluri-regional (3%), Irano-Turanian/ Mediterranean/ Saharo-Soudanian (2%), Irano-Turanian/ Euro-Siberian/ Saharo-Sindian (2%) and cosmopolitan (4%). The least geographical distributions were found in Euro-Mediterranean (0.5%), Saharo-Sindian (0.5%), Euro-Siberian (0.5%), and Mediterranean (0.5%) (Fig. 4B).

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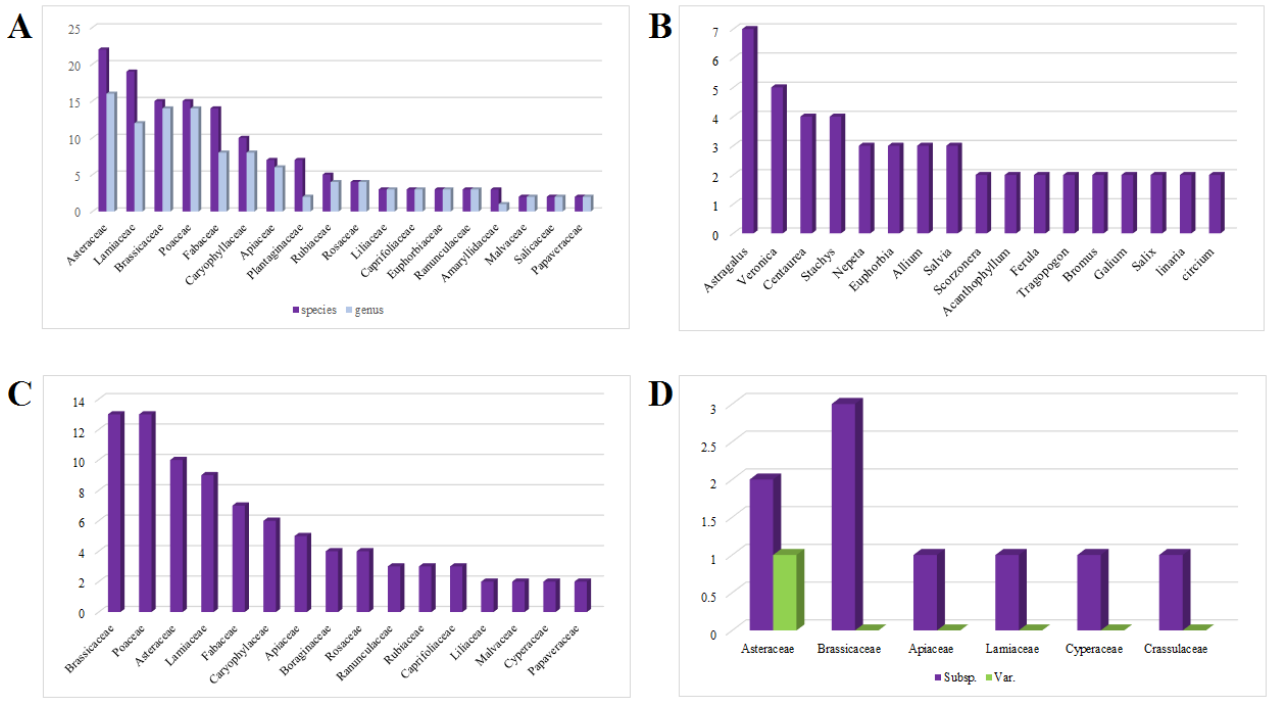


Fig. 3. A: The number of genera and species in each family, **B:** the maximum number of species in each genus, **C:** the maximum number of genera with 1 representative in each family, **D:** the number of sub species and variety for each family. Subsp.: subspecies, Var.: variety.

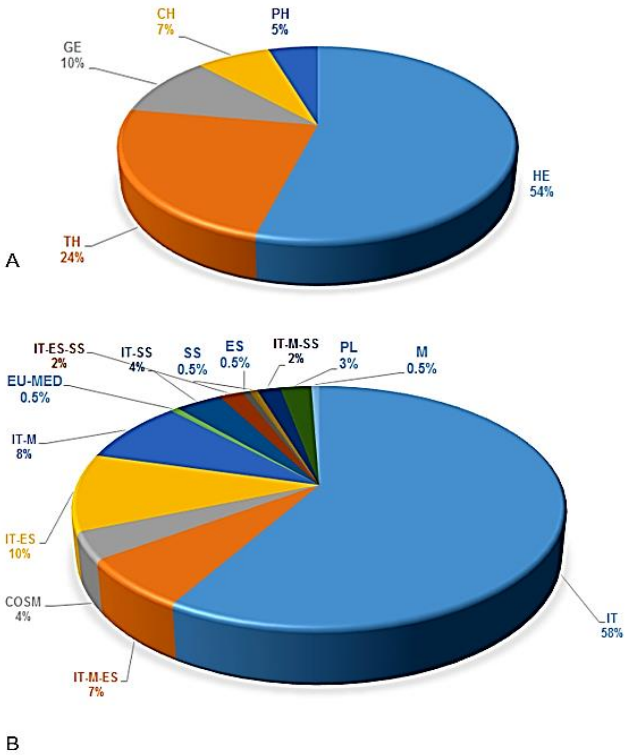


Fig. 4. A: The percentage of life forms, **B:** the percentage of chorotypes. TH: therophyte, HE: hemicryptophyte, GE: geophyte, CH: chamaephyte, PH: phanerophyte. IT: Irano-Turanian, ES: Euro-Siberian, IT-M: Irano-Turanian/Mediterranean, IT-ES: Irano-Turanian/Euro-Siberian, IT-SS: Irano-Turanian/Saharo-Sindian, IT-M-SS: Irano-Turanian/Mediterranean/Saharo-Sindian, IT-ES-SS: Irano-Turanian/Euro-Siberian/Saharo-Sindian, IT-M-ES: Irano-Turanian/Mediterranean/Euro-Siberian, SS: Saharo-Sindian, M: Mediterranean ,EU-MED: Euro/Mediterranean, PL: Pluri-regional, COSM: Cosmopolite

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Mono-regional families were also surveyed in this research. Asteraceae (19%), Lamiaceae (14%), Fabaceae (12%), Scrophulariaceae, Caryophyllaceae, Poaceae and Brassicaceae (8%) have been the most prominent taxa and other families ranged from 2-6% (Fig. 5A). Brassicaceae and Poaceae (21%), Asteraceae and Lamiaceae (17%), and Caryophyllaceae and Rubiaceae (12%) were found to be bi-regional families (Fig. 5B). Poaceae (23%), Fabaceae and Lamiaceae (16%), Geraniaceae, Brassicaceae and Cyperaceae (15%) comprised the highest proportion of pluri-regional distributions (Fig. 5C).

On the whole, 61%, 22% and 17% of the species were mono-regional, bi-regional and pluri-regional, respectively.

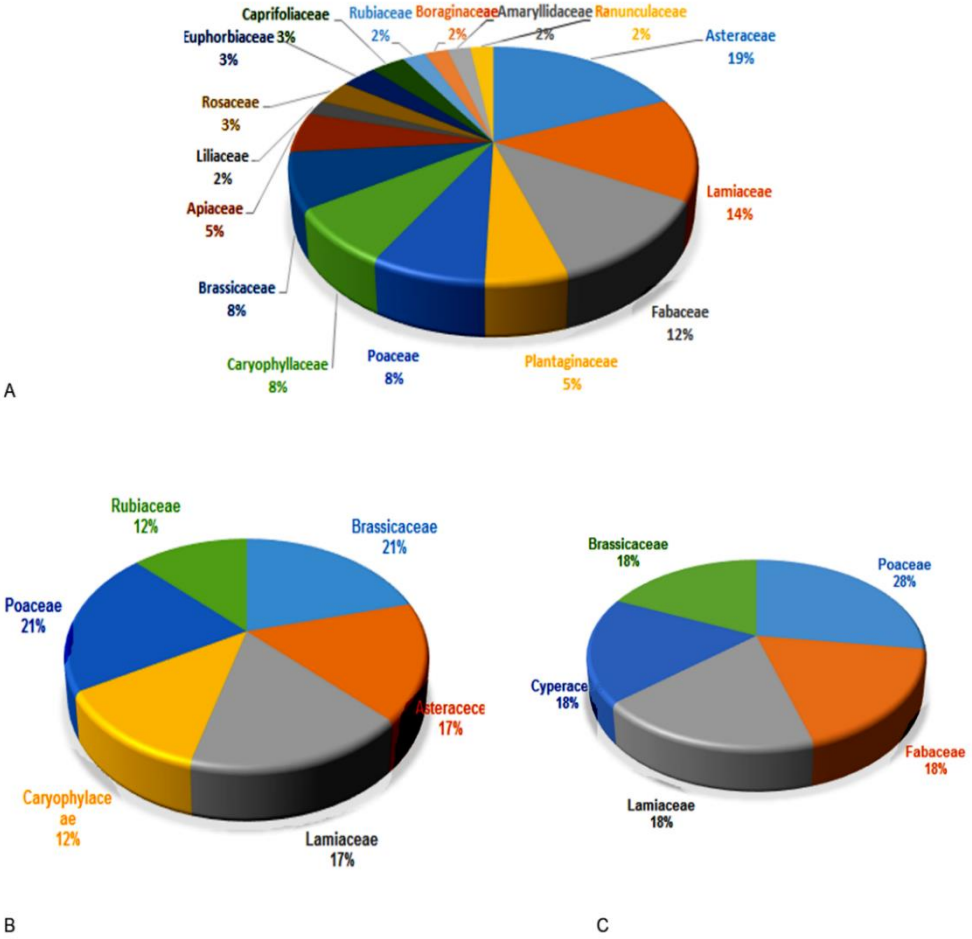


Fig. 5. A: Mono-regional distribution, **B:** bi-regional distribution, **C:** pluri-regional distribution.

A total of 34 medicinal families including 97 species were recognized in this region. The information enclosed the uppermost medicinal taxa belonged to Lamiaceae (19%), Fabaceae (14%), Asteraceae (11%), Brassicaceae (11%), Scrophulariaceae (6%), Caryophyllacea, Rosaceae, Poaceae and Apiaceae (5%) (Appendix I, Figs. 6A and B). Other families ranged from 3-4%. It was found that the studied area was dominated by Lamiaceae with 15 species and 9 genera, Asteraceae with 9 species and 7 genera, Fabaceae with 11 species and 5 genera, and Brassicacea with 9 species and 9 genera. As a result, 17 families, 45 genera and 48 species were classified as pasture plants. The highest number of such plants belonged to Poaceae (32%), Asteraceae (17%), Caryophyllaceae, Fabaceae (13%), Apiaceae (10%), and Brassicaceae and Boraginaceae (5%) (Appendix I, Figs. 6C and D).

Poaceae, with 13 species and 12 genera, and Asteraceae, with 7 species and 7 genera, were families with the highest variety in pasture plants. As for poisonous plants, 14 families, 16 genera and 23 species were found. Fabaceae (31%) and Euphorbiaceae (13%) were found to be the most diverse poisonous plants. Other families ranged from 4-9% (Appendix I, Figs. 6E and F). Fabaceae with 7 poisonous species belonged to 2 genera was the most diverse family in this criteria.

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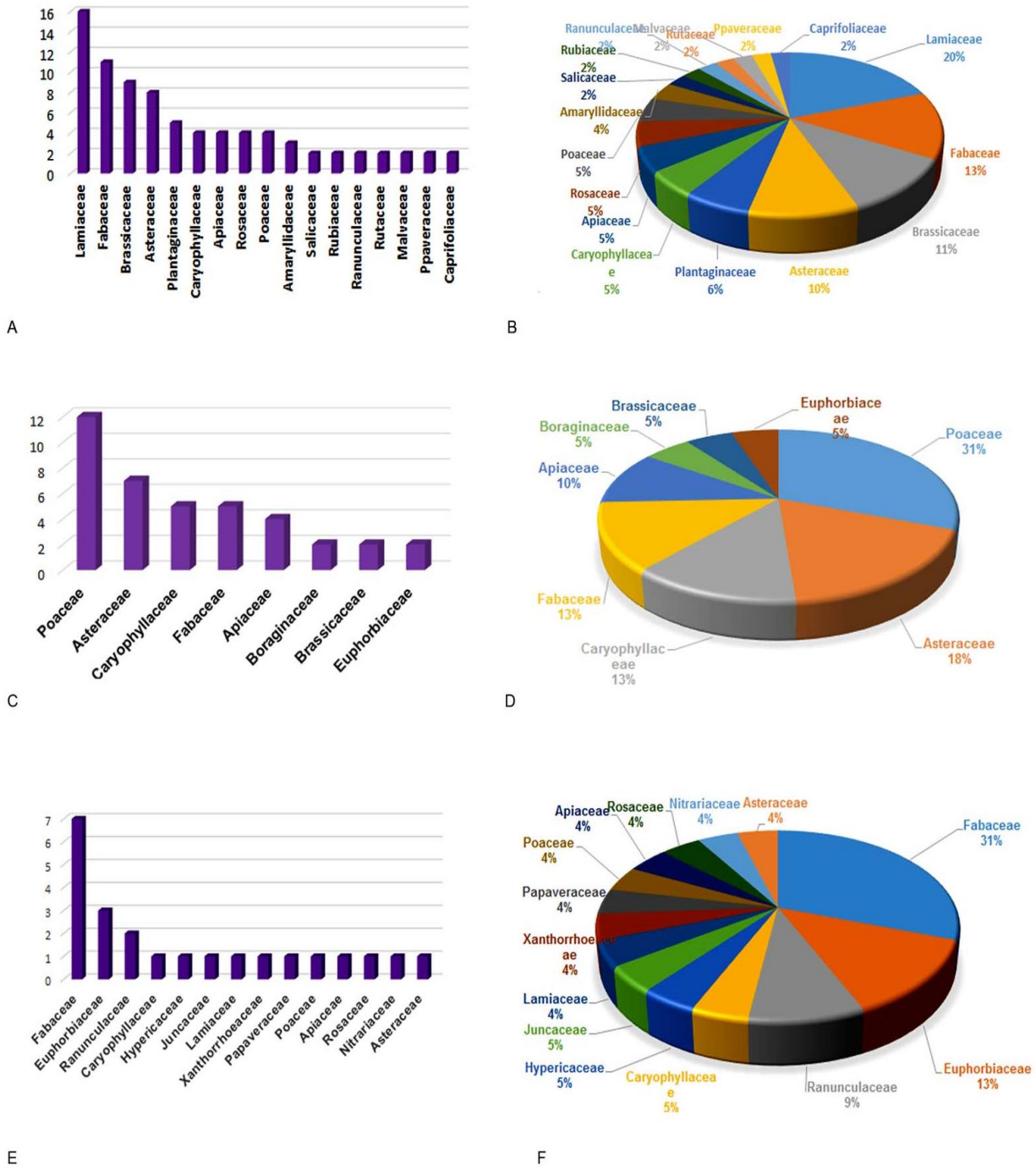


Fig. 6. A, B: The percentage of medicinal plants; **C, D:** the percentage of pasture plants; **E, F:** the percentage of poisonous plants.

A total 44 endemic species belonging to 15 families were also observed. The highest proportions of endemic species belonged to Lamiaceae (25%), Fabaceae (22%), Asteraceae (19%) and Brassicaceae (14%), while the rest of the studied families ranged from 6-8% (Appendix I, Fig. 7A). The highest number of endemic plants belonged to Lamiaceae with 9 species and 6 genera, Fabaceae with 8 species and 3 genera, and Asteraceae with 7 species and 7 genera. There were high numbers of endemic species belonging to *Astragalus* (6 species), *Nepeta* (3 species) and *Stachys* (2 species) genera (Appendix I, Fig. 7B). Ten families and 26 species of medicinal-endemic plants were also determined. Lamiaceae (27%), Fabaceae (23%), Brassicaceae (11%), Alliaceae (8%) and Asteraceae (7%) were found to be most diverse medicinal-endemic taxa (Fig. 7D). The highest number of medicinal-endemic plants belonged to Lamiaceae with 7 species, 6 genera and Fabaceae with 6 species, 2 genera (Fig. 7C).

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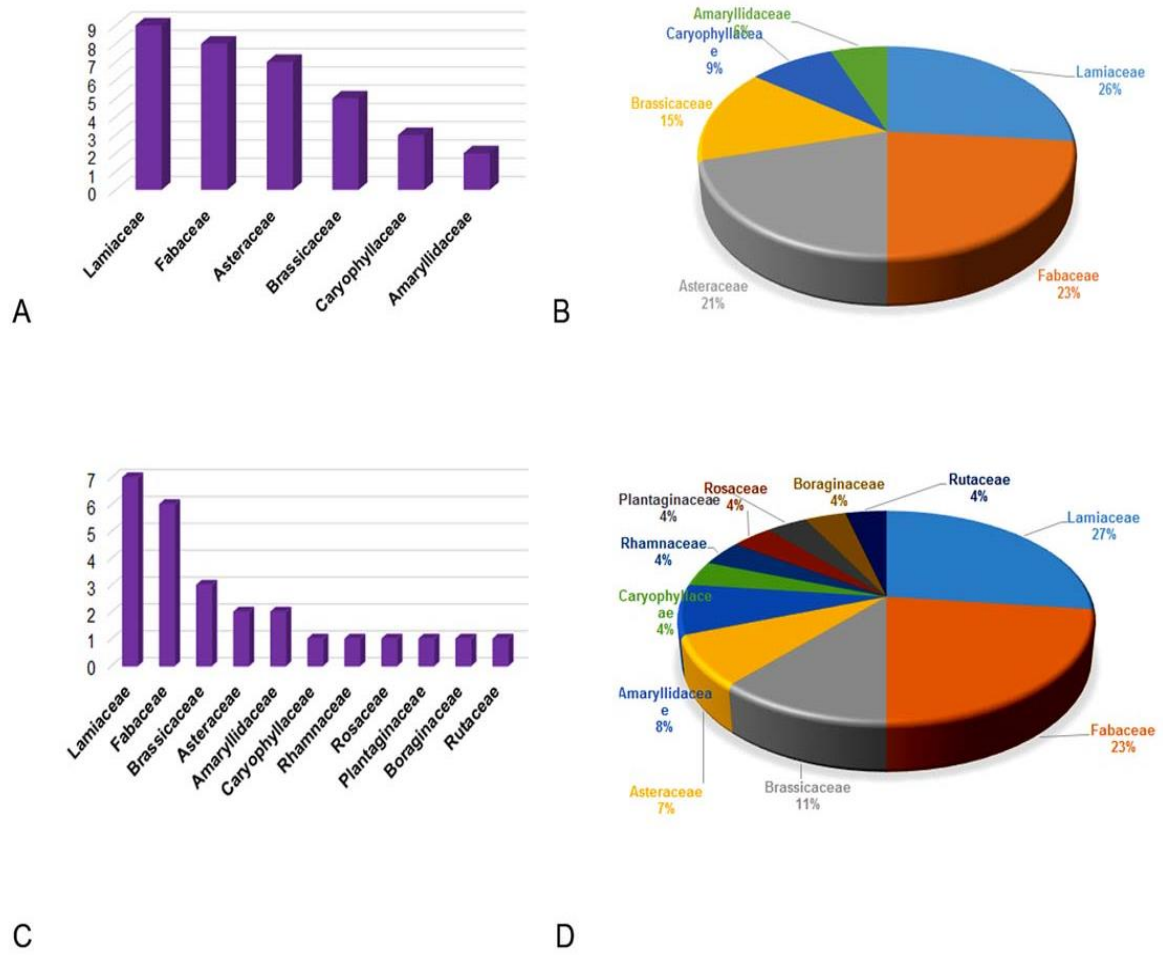


Fig. 7. A, B: The percentage of endemic plants; **C, D:** the percentage of medicinal-endemic plants.

Moreover, the most important endemic-medicinal taxa belonged to families such as Amarryllidaceae, Asteraceae, Boraginaceae, Caryophyllaceae, Lamiaceae, Fabaceae, Rhamnaceae, Rosaceae, Rutaceae and Plantaginaceae. Based on the protection status of each species, Asteraceae and Lamiaceae families had the highest value of LR (Low Risk; 55%). Moreover, Apiaceae, Brassicaceae, Liliaceae, and Poaceae were in appropriate conditions. The highest value of EN (Endangered; 12%) was found in Fabaceae. The highest vulnerable (VU; 18%) proportion was found in Fabaceae too (Appendix I, Figs. 8A, B). It appears that Fabaceae urgently needs more protection. The endemic species in this area showed high values of low risk (65%) and endangered case (23%) but the lowest values belonged to VU (6%) (Appendix I, Fig. 8C).

The vegetative forms of some species in this area are shown in Fig. 9. A total number of 171 species were collected and 166 species belonging to 39 families and 126 genera were accurately identified, which reflects the rich species diversity in this protected region. Despite the semi-arid climate, moderate winters with precipitation provide appropriate conditions for the growth of perennial and annual plants. Growth and development of plants in cold seasons might have been influenced by long periods of drought in summer. The highest numbers of species from other floristic studies in Isfahan Province were reported from the southern part of the province with 649 (Parishani, 2005) and 307 species (Khajedin & Yeganeh, 2010), the north-western part with 511 (Aryavand, 2001), 339 species (Yousefi, *et al.*, 2011), and 497 species (Yousefi, 2003), and the northern part with 398 (Batouli, 2003) and 63 species (Abdi & Afsharzadeh, 2012) regions, exhibiting high diversity and climate variations.

A high percentage of endemic and floristic richness was mostly associated with the Zagros Mountains (Zohary, 1973). The Palang Galoun protected region is one of the richest natural resources in the Zargos region. This is evident from the high percentage of medicinal and endemic species owing to geographical position and heterogeneous topography.

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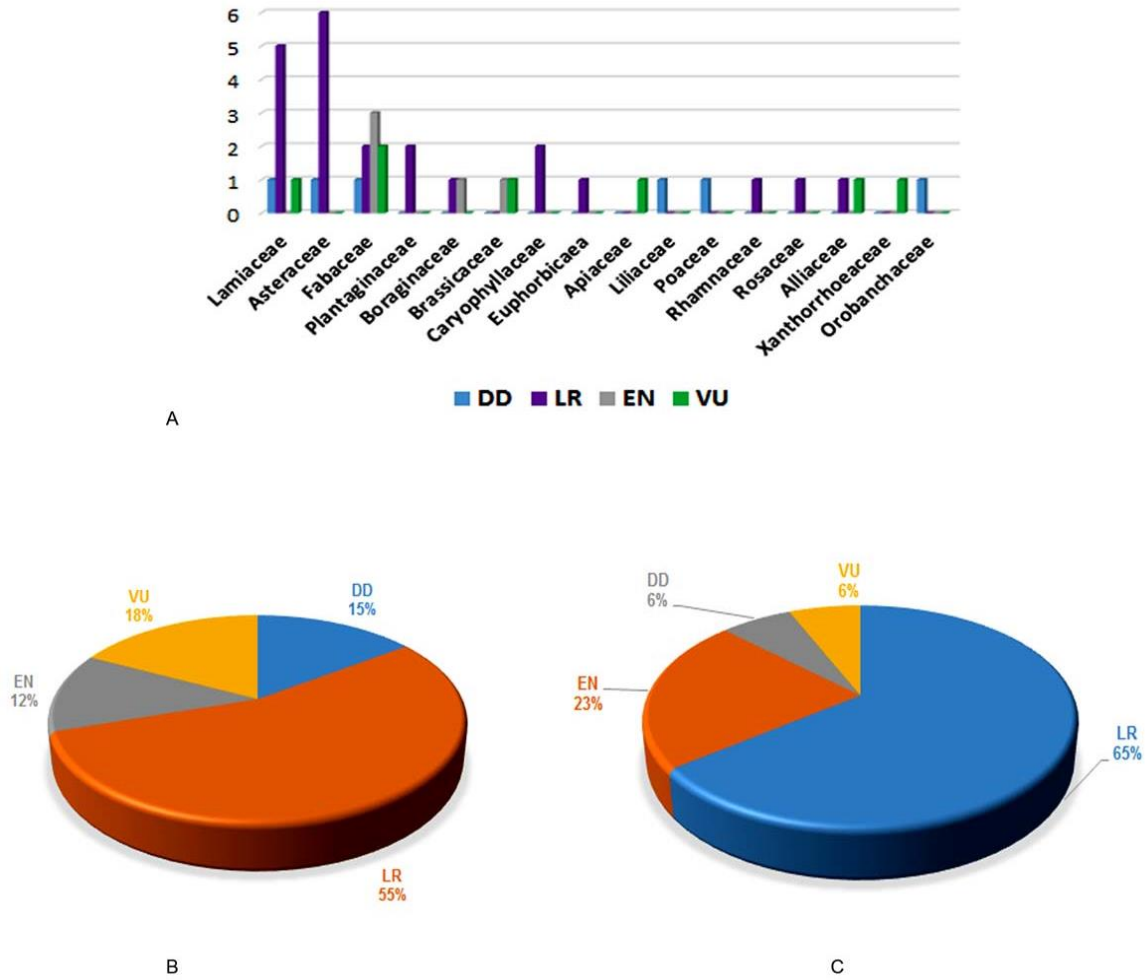


Fig. 8. A: The protected status of the families studied; **B:** the percentage of protected status; **C:** the protected status of endemic plants. DD: Data Deficiency, LR: Low Risk, EN: Endangered, VU: Vulnerable.

The studied taxa which were reported from Isfahan Province for the first time included *Hymenocrater elegans*, *Epilobium confusum*, *Lysimachia maritima* (L.) Galasso, Banfi & Soldano, *Cerasus chorassanica*, *Haplophyllum perforatum* Kar. & Kir., *Myosotis propinqua* and *Tragopogon porrifolius* L. subsp. *porrifolius*. In addition, the monocots plants were less common than dicots. It appears that the presence of annual herbaceous dicots affects the living conditions of monocots (Dolatkhahi & Nabipour, 2013). The most significant factors to retain the diversity of floristic elements originate from climatic, edaphic, geographical and biological conditions (Khajedin & Yeganeh, 2012). Notably, the life forms are also affected by these factors and reflect the climatic condition of each habitat (Raunkiaer, 1934). In addition, the precipitation rates and the duration of dry seasons constitute the main factors for life forms in this region. Plant life forms are reflections of compatibility (Raunkiaer, 1934). Most of the studied species belonging to permanent plants have been completely adapted to the environmental and edaphic conditions (Pairanj *et al.*, 2011). In this research, hemicryptophytes with 54% (90 species) and therophytes with 24% (39 species) were revealed to be the most dominant life forms. These forms are concentrated in the mountainous regions in cold climate of central Iran (Archibold, 1995; Yousefi, 2006). The high proportions of therophytes and hemicryptophytes are currently collected from Zarinchemeh, Isfahan Province (Kharazian *et al.*, 2016). Previous reports from the natural habitats of this province, such as Gazaan, Vanak, Ghamishlou and Mouteh, also confirmed the obtained results (Batouli, 2003; Yousefi, 2003; Parishani, 2005; Abbasi *et al.*, 2012). The existence of hemicryptophytes have also been originated via adaptation to cold climate and grazing (Sharifi *et al.*, 2012; Kharazian *et al.*, 2016). They are frequently found in cold climates and mountainous highlands (Raunkiaer, 1934; Mobayen, 1980; Archibold, 1995), which supports our results. These life forms adapt to a particular area by developing different survival mechanisms (Heydari *et al.*, 2013).

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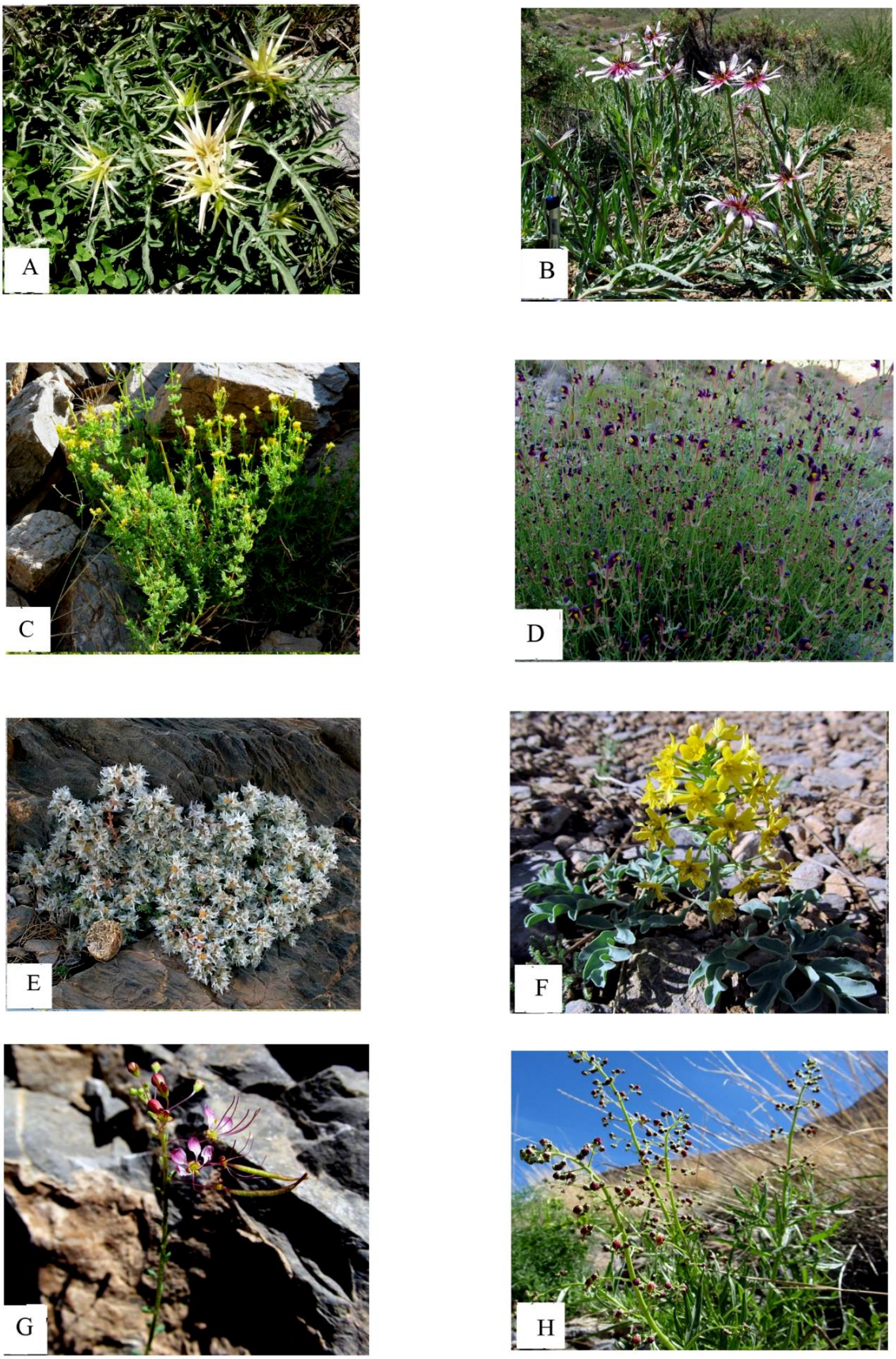


Fig. 9. The vegetative forms of some species in Palang Galoun region. **A:** *Centaurea iberica*, **B:** *Tragopogon porrifolius*, **C:** *Hypericum scabrum*, **D:** *Scutellaria multicaulis*, **E:** *Paronychia caespitosa*, **F:** *Leontice armeniaca*, **G:** *Cleome iberica*, **H:** *Scrophularia leucoclada*.

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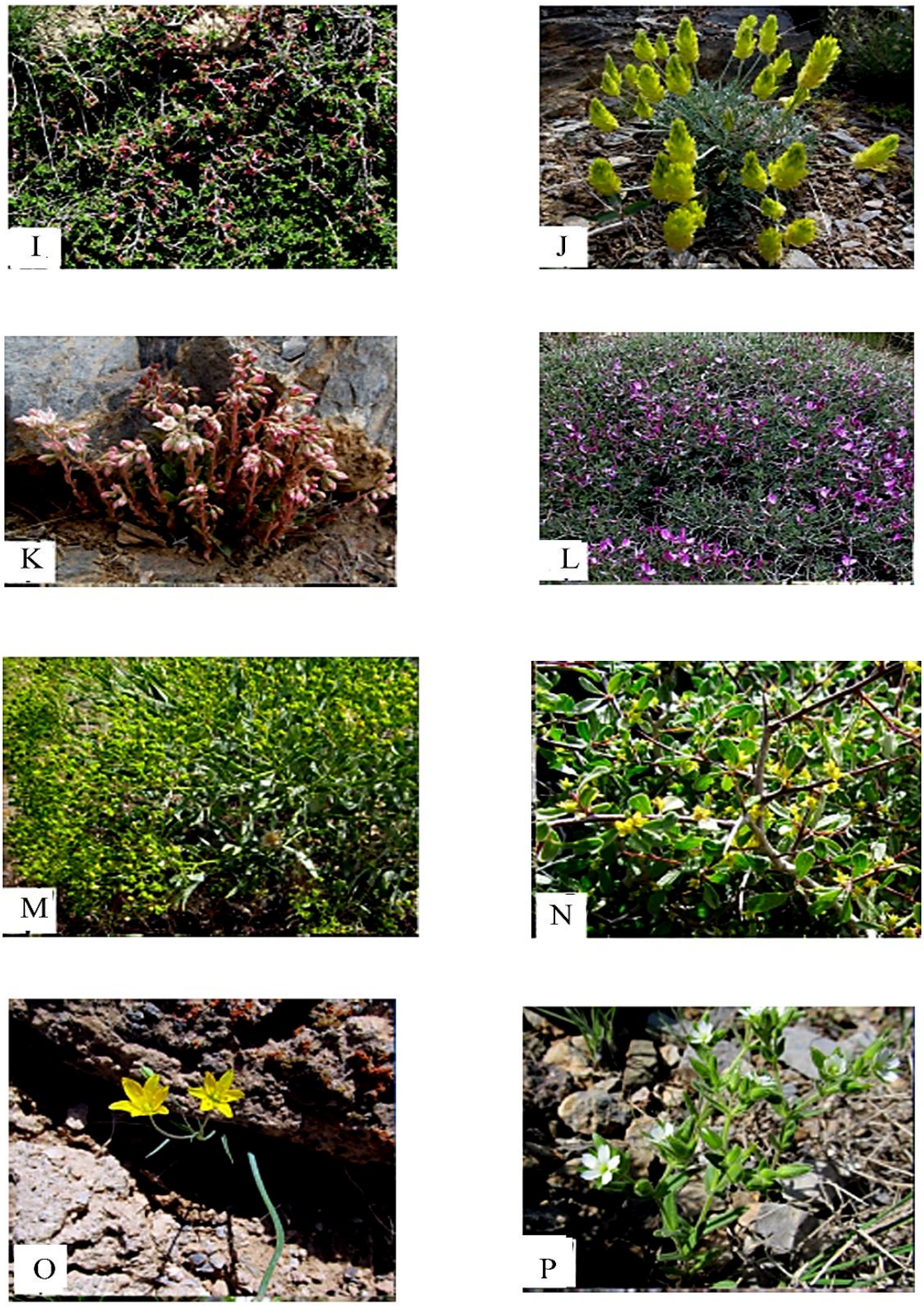


Fig. 9. Continued. **I:** *Cerasus chorassanica*; **J:** *Astragalus chrysostachys*; **K:** *Rosularia sempervivum*; **L:** *Onobrychis cornuata*; **M:** *Haplophyllum perforatum*; **N:** *Rhamnus persica*; **O:** *Gagea villosa*; **P:** *Agrostemma githago*.

These factors contribute to the creation of the most dominant and resistant species in the Palang Galoun region.

The high presence of therophytes is also due to the destruction of the region. This life form has a minor tolerance to hard climatic conditions, such as low rainfall and long periods of drought (Eshghi Malayeri *et al.*, 2013; Kharazian *et al.*, 2016; Solinska *et al.*, 1997). Despite the increase of temperature, grazing and unfavorable climatic conditions, their life cycle is quickly completed, producing the seeds of their next generation (Batouli, 2003, Asri, 2003). Moreover, the presence of therophytes indicates the intensity of human intervention (Gharamaninejad & Agheli, 2009).

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The chamaephyte life form mostly contributes to maintaining soil cover and is able to tolerate cold highland climate. Its low presence (7%) in this region leads to soil erosion. This is substantiated by previous reported results from Isfahan Province (Yousefi *et al.*, 2011; Abdi & Afsharzadeh, 2012; Kharazian *et al.*, 2016). Notably, different life forms of *Astragalus* species (chamaephytes and hemicryptophytes) which definitely prefer cold highlands and semiarid conditions were previously reported (Gurgin Karaji *et al.*, 2013). The high percentage of this taxon might be correlated with its compatibility with mountainous areas, (Gurgin Karaji *et al.*, 2013) which provides a shelter for therophytes. It has been shown that soil protection, especially in mountain's slopes, could be attributed to *Acanthophyllum* C. A. Mey. and *Astragalus* species (Batouli, 2003). In addition, a similar poor status was observed in phanerophyte life form (5%) resulting from flood and severe water erosion (Eshghi Malayeri *et al.*, 2013; Kharazian *et al.*, 2016). The cold highlands and semiarid regions were also inhibited the prominent presence of phanerophytes (Gurgin Karaji *et al.*, 2013). Phanerophyte life forms are less consistent and have a relatively low tolerance to dry conditions. It seems that this region would not present appropriate conditions for the establishment of trees or shrubs (Zohary, 1973). It was noted that there were rare instances of trees and shrubs in the sub-province of central Iran (Zohary, 1973). The occurrence of this chorotype also correlates to high temperatures of short vegetative season and low temperatures during other seasons (He *et al.*, 2007). The low percentage of phanerophyte life forms is supported by other evidence from Isfahan Province (Batouli, 2003; Yousefi *et al.*, 2011; Kharazian *et al.*, 2016).

The low occurrence of geophyte life forms (10%) is the result of unsuitable climatic conditions for the growth of temperate vegetation, shallow soil and declining underground reserves. However, these life forms are tolerant to grazing (Roques *et al.*, 2001). They remain in the soil in the form of bulbs and rhizomes during cold weather conditions (Parishani, 2005; Naghinejad *et al.*, 2010). Geophytes presence declines in highland regions to the benefit of hemicryptophytes (Naghinejad *et al.*, 2010). The low occurrence of geophytes is confirmed by previous reports from Isfahan Province (Batouli, 2003; Yousefi *et al.*, 2011). High resistance to edaphic and climatic conditions in the species studies from the Palang Galoun region is apparent owing to the high presence of perennial species. The high percentage of Asteraceae members indicates their adaptation to the semiarid conditions, the high destruction rate and the extension of farming in the area (Heydari *et al.*, 2013; Naghinejad *et al.*, 2010; Gurgin Karaji *et al.*, 2013; Kharazian *et al.*, 2016). A strategy to avoid grazing is definitely shown by the presence of such genera as *Centaurea* L. and *Cirsium* Mill. (Pairanj *et al.*, 2011). The high percentages of Fabaceae and Poaceae members are potential evidences for forage value and soil protection (Pairanj *et al.*, 2011).

It has been revealed that *Astragalus* is one of the prominent elements of mountainous areas in Iran, Afghanistan and the Mediterranean region. It is well adapted to high solar radiation, grazing and dry areas (Pairanj *et al.*, 2011; Ghahremaninejad *et al.*, 2017). In addition, the high number of species belonging to both Lamiaceae and Fabaceae indicates the presence of certain edaphic conditions (Abdi & Afsharzade, 2012; Kharazian *et al.*, 2016). On the other hand, the destruction of the ecosystem is exhibited by the presence of *Euphorbia bungei* Boiss. (Karimi, 2009). Our findings on phytochoria distribution relate to portions of the Irano-Turanian region (58%) which is based on previous reports from Isfahan Province (Yousefi *et al.*, 2011; Kharazian *et al.*, 2016).

The general appearance of the Flora of Iran is well represented by Irano-Turanian region (70%). Other chorotypes such as Saharo-Sindian, Mediterranean and Euro-Siberian are less prevalent (Zohary, 1973). It is known that the unique features of the Irano-Turanian region are correlated with certain genera as *Astragalus, Centaurea, Nepeta, Stachys, Scorzonera* L., *Acanthophyllum, Euphorbia* L., *Ferula* L. and *Allium* L. (Hedge & Wendelbo, 1970) which confirms our results. In particular, the original centers of *Atragalus* speciation have been reported to be found in Iran (Zohary *et al.*, 1999). Moreover, Irano-Turanian elements are found in mountainous areas of central Iran (Yousefi *et al.*, 2011). It is also characterized by low rainfall and prolonged drought (Heydari *et al.*, 2013). Evidence shows that 80% of the floristic elements are influenced by Irano-Turanian region (Zohary *et al.*, 1999). Other mono-regional, bi-regional and pluri-regional elements were also confirmed by previous results from Isfahan Province (Batouli, 2003; Yousefi *et al.*, 2011; Abdi & Afsharzadeh, 2012). In fact, an ecotone zone is considered to exist between the Irano-Turanian and other chorotype elements of this area. Other chorotypes such as Mediterranean, Euro-Siberian, Euro-Siberian/Mediterranean and Irano-Turanian/ Saharo-Sindian/ Saharo Arabian/ Mediterranean from Iran were also described (Batouli, 2003; Yousefi *et al.*, 2011; Abdi & Afsharzadeh, 2012). Mediterranean elements were also identified in the forest floras of this region (Zohary *et al.*, 1999).

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The Irano-Turanian region was affected by Saharo-Sindian and Mediterranean elements, as shown by our results. The effect and influence of each vegetation region are related to their floristic richness and extent (Yousefi, 2006). Some of the plant species are more common in several regions. It has been postulated that concerns about species extinction could be reduced as a result of the increase of habitat restoration and pluri-regional distributions (Pairanj *et al.*, 2011). Mono-regional plants scattering is threatened by extinction, which possibly prevents reintegration (Pairanj *et al.*, 2011). A total of 44 endemic species display the most remarkable floristic elements and high species richness in Isfahan Province. Previous studies have reported more endemic species, 85%, in different families were found to be attributed to the Irano-Turanian region (Batouli, 2003; Safikhani *et al.*, 2005; Gurgin Karaji *et al.*, 2013). Fabaceae and Lamiaceae families comprised 60% of endemic species (Yousefi, 2006) which strongly supports our results. The Zagros region and Irano-Turanian areas are considered to be the richest regions in terms of endemism (Zohary, 1973; Ghahreman & Attar, 1998). Our results showed 37 endemic species localized only in the Irano-Turanian region. *Allium stipitatum* was introduced as an endemic species of the Zagros Mountains illustrating the Zagros endemism patterns (Yousefi *et al.*, 2011).

According to Ghahreman & Attar (1998) all of the Iranian endemic plants might be characterized as rare species. Consequently, there are a number of endemics which are urgently in need of protection. Our findings on medicinal plants are in agreement with previous results from Isfahan Province (Parishani, 2005; Kharazian *et al.*, 2016). Moreover, the pasture plants in other areas from Isfahan Province were found to belong to Poaceae, Fabaceae, Apiaceae and Asteraceae families (Parishani, 2005; Kharazian *et al.*, 2016), which approved the obtained results of the present project. Similarly, previous studies found that the poisonous plants belonged to Fabaceae, Euphorbiaceae and Rununculaceae, which support our results (Parishani, 2005; Kharazian *et al.*, 2016). Based on their presence in different floristic units, the species of *Peganum harmala*, *Euphorbia* sp. and *Eremurus persicus* grow in degraded and eroded areas (Zohary, 1973).

Most of the studied species were assigned in LR status (22 species), which reflects the optimal conditions in this protected region. Favorable growth conditions are comparable with other regions of Isfahan Province (Yousefi *et al.*, 2011; Khajedin & Yeganeh, 2012). The maximum value of EN was foun d in Fabaceae but in the case of other families EN status was at a lower rates. This might be due to indiscriminate harvesting of the members of the genus (Jalili & Jamzad, 1999; Abdi, 2008). In previous results, Fabaceae, Asteraceae and Lamiaceae were assigned in EN status, which is in agreement with our findings (Jalili & Jamzad, 1999; Abdi, 2008).

On the contrary, Lamiaceae members were found in appropriate conditions. In the studied region, endemic species are mainly assigned to LR and EN status. Moreover, high value of VU status was found in Fabaceae, while other families showed low values for the status. In previous reports more vulnerable and endangered cases occurred mostly in perennial species (Jalili & Jamzad, 1999).

CONCLUSION

Based on reports from floristic studies in Iran, 65% of endemic species were at LR and 23% of them were at EN status. The vulnerable species have been threatened by the destruction of vegetation resulting from overgrazing, changes in pastures and limited distribution (Abdi, 2008). Limited geographical distribution, biological restrictions and intensity of human interference are the most important factors in determining the risk status of endangered species. Extinction and destruction of species result from different factors such as plant utilization by humans and animals, industrialization, plowing and land use, urban and rural development, pest and diseases, droughts, erosional events, fire, and harsh environmental conditions and intense competition (Karimi, 2009). 93% of endangered and vulnerable species are affected by these factors (Jalili & Jamzad, 1999).

It appears that the most practical methods for saving the natural and genetic resources are to cultivate, domesticate and conserve the germ-plasm of species (Abdi, 2008). The importance of the entrance of the wild endemic and medicinal species from natural habitats into agricultural projects was confirmed by Ghahreman & Attar (1998). Moreover, autecological studies, seed collecting, and avoidance of plant harvest are preferred as the main conservation strategies, which should be issued by the relevant authorities (Abdi, 2008). Preparation and implementation of lasting protection projects in the Palang Galoun ecosystem have increased the level of pastures, and biodiversity conservation programs should be given the utmost consideration (Abdi, 2008). The results of the protected status of plants studied in this region are the basis for germ-plasm retention and constitute a suitable reference for the planners and executives who lead land use projects.

It is suggested that the first step to preserve and support the threatened species exclusively for

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endemic species with protected status is to identify them. On the other hand, natural resource management in Isfahan Province, coupled with a strong conservation policy, should adequately prevent the erosional events and damage to the environment. The most rigorous ways to prevent the extinction of endemic, medicinal species and protect valuable pasture should be focused on the grazed pastures, seed formation, gene bank establishment, the seeds planted in the botanical gardens and reproducing them (Karimi, 2009).

ACKNOWLEDGEMENT

The authors are thankful to the Research Deputy of Shahrekord University for providing financial support.

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How to cite this article:

Sadeghipour, F., Kharazian, N. and Afsharzadeh, S. 2018. Floristic studies of vegetation in Palang Galoun protected region, Isfahan province, Iran. – Nova Biol. Reperta 5 (3): 274-290.

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Appendix 1. The list of species from Palan Galoun region.
Life forms, chorotype, medicinal, pasture and poisonous plants, and endemic species are given for each plant name. The species have been reported for the first time in Isfahan province marked with asterisk (*). The numbers in brackets show the herbarium voucher specimens (SHU: Herbarium of Shahrekord University).
Ch: chamaephyte, T: therophyte, H: hemicryptophyte, Ph: phanerophyte, G: geophyte. IT: Irano-Turanian, ES: Euro-Siberian, IT-M: Irano-Turanian/Mediterranean, IT-ES: Irano-Turanian/Euro-Siberian, IT-SS: Irano-Turanian/Saharo-Sindian, IT-M-SS: Irano-Turanian/Mediterranean/Saharo-Sindian, IT-ES-SS: Irano-Turanian/Euro-Siberian/Saharo-Sindian, IT-M-ES: Irano-Turanian/Mediterranean/Euro-Siberian, SS: Saharo-Sindian, M: Mediterranean ,EU-MED: Euro/Mediterranean, Cosm: Cosmopolite, Pl: Pluri-regional, DD: Data Deficiency, LR: Low Risk, EN: Endangered, VU: Vulnerable, En: endemic, Pa: pasture, Po: poisonous, M: medicinal, SA: Sadeghipour.

Amaryllidaceae J.St.-Hil.: *Allium bungei* Boiss. [G, IT, En, LR, Pa, M] (SA C62); *Allium scabriscapum* Boiss. [G, IT-SS, M] (SA B29); *Allium stipitatum* Regel [G, IT, En, VU, M] (SA B54). **Apiaceae** Lindl.: *Astrodaucus persicus* (Boiss.) Drude [H, IT] (SA F14); *Conium maculatum* L. [H, Pl, Pa, Po, M] (SA D4); *Eryngium billardieri* Dellile [H, IT, Pa] (SA D28); *Ferula haussknechtii* H.Wolff ex Rech.f. [H, IT, M] (SA B38); *Ferula ovina* (Boiss.) Boiss. [H, IT, VU, Pa, M] (SA B37); *Pimpinella tragium* Vill. subsp. *polyclada* (Boiss. et Heldr.) Tutin [H, IT] (SAC40); *Scandix stellata* Banks & Sol. [T, IT-ES-M, M, Pa] (SA C30). **Asteraceae** Bercht. & J.Presl: *Achillea santolinoides* Lag. subsp. *wilhelmsii* (K.Koch) Greuter [H, IT, Pa, M] (SA C10); *Anthemis odontostephana* Boiss. [T, IT, En, LR] (SA C58); *Askellia flexuosa* (Ledeb.) W.A.Weber [G, IT] (SA C64); *Centaurea iberica* Trevir. ex Spreng. [H, IT-ES] (SA G18); *Centaurea ispahanica* Boiss. [H, IT, En, LR, M] (SA C23); *Centaurea persica* Boiss. [H, IT] (SA B36); *Centaurea virgata* Lam. subsp. *squarrosa* (Boiss.) Gugler [H, IT-ES] (SA C8); *Cirsium bracteosum* DC. var. *brevicuspis* Boiss [H, IT, En, LR] (SA D22); *Cirsium palustre* (L.) Coss. ex Scop. [H, IT, Pa] (SA D23); *Cousinia bachtiarica* Boiss. & Hausskn. [H, IT, En, DD, Pa] (SA C26); *Cyanus segetum* Hill [T, COSM, M] (F11); *Echinops polygamus* Bunge [T, IT, En, LR] (SA D10); *Echinops* sp. [Pa] (SA B56); *Gundelia tournefortii* L. [H, IT-M, Pa, M] (SA C56); *Psephellus leuzeoides* (Jaub. & Spach) Wagenitz [H, IT, M] (SA B11); *Rhaponticum repens* (L.) Hidalgo [H, IT-ES] (SA B33); *Scorzonera cinerea* Boiss. [H, IT, Pa, M] (SA B17); *Scorzonera rupicola* Hausskn. [H, IT, En, LR] (D16); *Seratula latifolia* Boiss. [H, IT] (SA B45); *Tanacetum polycephalum* Sch.Bip. [H, IT, En, LR, Po, M] (SA B65); *Taraxacum microcephaloides* Soest [H, IT, M] (SA C51); *Taraxacum* sp. (SA B57); *Tragopogon dubius* Scop. [T, EM, Pa] (SA B55); *Tragopogon porrifolius* L. [H, EM, M, *****] (SA B68). **Berberidaceae** Juss.: *Leontice armeniaca* Belanger [G, IT, M] (SA B20). **Biebersteiniaceae** Schnizl.: *Biebersteinia multifida* DC. [G, IT-ES-M, M] (SA A6). **Boraginaceae** Juss.: *Myosotis propinqua* Fisch. & C.A.Mey. ex Ledeb. [T, IT-ES, Pa, *****] (SA B34); *Nonea caspica* (Willd.) G.Don [T, IT- ES-M, Pa] (SA B23); *Onosma elivendica* Wettst. ex Stapf [H, IT, En, EN] (SA C15); *Trichodesma aucheri* DC. [T, IT, En, LR, M] (SA D20). **Brassicaceae** Burnett: *Aethionema virgatum* (Boiss.) Hedge [H, IT, M] (SA B61); *Alyssum turkestanicum* Regel & Schmalh. [T, IT] (SA B28); *Arabis aucheri* Boiss. [T, IT-ES, M] (SA F1); *Barbarea plantaginea* DC. [H, Pl, M] (SA G10); *Chalcanthus renifolius* (Boiss. & Hohen.) Boiss. [G, IT, En, M] (SA B59); *Diplotaxis harra* (Forssk.) Boiss. [H, IT-ES, M] (SA G12); *Draba nuda* (Bél.) Al-Shehbaz & M. Koch [T, IT] (SA C43); *Erucaria cakiloidea* (DC.) O.E.Schulz [T, IT, En, M] (SA C38); *Erysimum repandum* L. [T, IT, En, M] (SA B26); *Fibigia macrocarpa* (Boiss.) Boiss. [H, IT-ES] (SA C17); *Hesperis persica* Boiss. subsp. *kurdica* (F.Dvořák & Hadač) F.Dvořák [H, IT-M, En, EN, Pa] (SA B25); *Isatis cappadocica* Desv. [H, IT, VU] (SA C54); *Lepidium draba* L. subsp. *chalepensis* (L.) P.F.Foum. [H, COSM, M] (SA F2); *Lepidium persicum* Boiss. subsp. *arianum* Hedge [H, IT-ES-SS, En, Pa, M] (SA C48); *Leptaleum filifolium* (Willd.) DC. [T, IT-SS] (SA B12). **Caprifoliaceae** Juss.: *Lonicera caucasica* Pall. [Ph, IT, M] (SA B50); *Pterocephalus canus* Coult. ex DC. [H, IT, Pa] (SA B53); *Valeriana sisymbrifolia* Kabath. [H, IT, M] (SA B60). **Caryophyllaceae** Juss.: *Acanthophyllum acerosum* Sosn. [Ch, IT, Pa, M] (SA D2); *Acanthophyllum mucronatum* C.A.Mey. [Ch, IT, M] (SA E1); *Acanthophyllum* sp. (SA C31); *Agrostemma githago* L. [T, ES, M] (SA B2); *Arenaria persica* Boiss. [Ch, IT, En, LR] (SA B32); *Dianthus orientalis* Adams [H, IT, Pa] (SA D12); *Gypsophila virgata* Boiss. [T, IT, En, Pa, Po, M] (SA D8); *Mesostemma kotschyana* (Fenzl ex Boiss.) Vved. [H, IT-ES, Pa] (SA C44); *Paronychia caespitosa* Stapf [H, IT, En, LR] (SA C61); *Silene chlorifolia* Sm. [Ch, IT-M, Pa] (SA D19); *Silene spergulifolia* (Willd.) M.Bieb. [H, IT-M] (SA F9). **Cleomaceae** Horan.: *Cleome iberica* D.C. [H, IT-M, M] (SA D18). **Convolvulaceae** Juss.: *Convolvulus arvensis* L. [T, Pl, M] (SA C35). **Crassulaceae** J.St.-Hil.: *Rosularia sempervivum* (M.Bieb.) A. Berger subsp. *sempervivum* (M.Bieb.) Berger [H, IT-M] (SA B47), (SA C14). **Cyperaceae** Juss.: *Carex stenophylla* Wahlenb. subsp. *stenophyloides* (V.I.Krecz.) T.V.Egorova [G, IT-ES-SS] (SA B4); *Scirpoides holoschoenus* (L.) Soják [G, IT-ES-SS] (SA B62). **Euphorbiaceae** Juss.: *Euphorbia bungei* Boiss. [H, IT, Pa, Po] (SA B27); *Euphorbia*

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[DOR: 20.1001.1.24236330.1397.5.3.6.8]
[DOI: 10.29252/nbr.5.3.274]

orientalis L. [H, IT, Po, M] (SA D26); *Euphorbia polycaulis* Boiss. & Hohen. [H, IT, En, LR, Pa, Po] (SA G20). **Fabaceae** Lindl.: *Astragalus cephalantus* DC. [Ch, IT, En, EN, Po, M] (SA B18); *Astragalus chrysostachys* Boiss. [Ch, IT, En, EN, Po, M] (SA C13); *Astragalus cyclophyllon* Beck [H, IT, En, EN, Pa, Po, M] (SA B63), (SA B10); *Astragalus ischredensis* Bunge [H, IT, En, Po, M] (SA B6); *Astracantha microcephala* (Willd.) Podlech [T, IT-ES-M, EN, M] (SA D9); *Astragalus microphysa* Boiss. [Ch, IT, En] (SA F12); *Astragalus ovinus* Boiss. [H, IT, EN, Pa, Po, M] (SA B46); *Astragalus patrius* Maassoumi [H, IT, En, VU, Po, M] (SA B64); *Cicer spiroceras* Jaub. & Spach [H, IT, En, LR] (SA C27); *Onobrychis cornuta* (L.) Desv. [Ch, IT] (SA C46); *Securigera varia* (L.) Lassen [H, IT-ES, Pa, M] (SA C18); *Sophora alopecuroides* L. [H, IT, Po, M] (SA D24); *Trifolium repense* L. [H, IT-ES-M, DD, Pa, M] (SA F3); *Trigonella aphanoneura* Rech.f. [H, IT, En, Pa, M] (SA C57). **Geraniaceae** Juss.: *Geranium tuberosum* L. [H, IT-ES-M, Pa] (SA A2). **Hypericaceae** Juss.: *Hypericum scabrum* L. [H, IT, Po, M] (SA D17). **Ixioliriaceae** Nakai: *Ixiolirion tataricum* (Pall.) Schult. & Schult.f. [G, IT-SS-M, M] (SA B8). **Juncaceae** Juss.: *Juncus inflexus* L. [G, COSM, Po, M] (SA G1). **Lamiaceae** Martinov**:** *Clinopodium graveolens* (M.Bieb.) Kuntze [T, IT-ES-M] (SA F6); *Eremostachys molucelloides* Bunge [H, IT, M] (SA C39); *Hymenocrater elegans* Bunge [Ch, IT, En, M, *****] (SA C41); *Lophanthus sessilifolius* (Bunge) Levin [H, IT, En, LR, Po, M] (SA B66); *Nepeta kotschyi* Boiss. [Ch, IT, En, LR] (SA B41); *Nepeta pungens* (Bunge) Benth. [T, IT, M] (SA C29); *Nepeta saccharata* Bunge [T, IT, En, Pa] (SA F13); *Phlomis aucheri* Boiss. [H, IT, En, LR, M] (SA C55); *Phlomoides laciniata* (L.) Kamelin & Makhm. [H, IT, M] (SA C59); *Salvia hydrangea* DC. ex Benth. [H, IT-SS, M] (SA C22); *Salvia macroclamys* Boiss. & Kotschy [H, IT-SS, DD] (SA B22); *Salvia nemorosa* L. [H, IT-ES, M] (SA D25); *Scutellaria multicaulis* Boiss. [H, IT, En, M] (SA D3); *Stachys inflata* Benth. [H, IT, M] (SA B44); *Stachys ixodes* Boiss. & Hausskn. [H, IT, En, LR, M] (SA C34); *Stachys lavandulifolia* Vahl [H, IT-ES-M, M] (SA B39); *Stachys pilifera* Benth. [H, IT, En, LR, M] (SA B67); *Teucrium capitatum* L. [H, IT-M, M] (SA C63); *Ziziphora clinopodioides* Lam. subsp. *rigida* (Boiss.) Rech.f. [Ch, IT, En, VU, M] (SA D13). **Liliaceae** Juss.: *Gagea* sp. (SA F5); *Gagea villosa* (M.Bieb.) Sweet [G, IT-ES, DD] (SA A3); *Ornithogalum orthophyllum* Ten. [G, IT] (SA B21); *Tulipa montana* Lindl. [G, IT, Po] (SA B30). **Malvaceae** Juss.: *Alcea rosea* L. [H, M, M] (SA D21); *Malva neglecta* Wallr. [T, IT-ES-M, M] (SA C36). **Nitrariaceae** Lindl.: *Peganum harmala* L. [H, IT-SS-M, Pa, Po, M] (SA C60).**Onagraceae** Juss.: *Epilobium confusum* Hausskn. [H, IT-ES, *****] (SA G15). **Orobanchaceae** Vent.: *Pedicularis straussii* Hausskn. [H, IT, En, DD] (SA C47). **Papaveraceae** Juss.: *Fumaria asepala* Boiss. [T, IT-ES, M] (SA B15); *Papaver decaisnei* Hochst. & Steud. ex Elkan [T, IT, Po, M] (SA B16). **Plantaginaceae** Juss.: *Linaria chalepensis* (L.) Miller [T, IT-M, M] (SA B52); *Linaria lineolata* Boiss. [T, IT] (SA C53); *Veronica biloba* Schreb. ex L. [T, IT] (SA C42); *Veronica campylopoda* Boiss. [T, IT, M] (SA A7); *Veronica farinosa* Hausskn. [T, IT, En, LR, M] (SA G14); *Veronica oxycarpa* Boiss. [H, COSM, M] (SA G17); *Veronica rubrifolia* Boiss. [T, IT, LR, M] (SA E2). **Poaceae** Barnhart: *Alopecurus arundinaceus* Poir. [G, IT-ES, Pa] (SA G6); *Arrhenatherum kotschyi* Boiss. [H, IT, Pa, M] (SA B42); *Bromus tectorum* L. [T, COSM, Pa, M] (SA B14); *Bromus tomentellus* Boiss. [H, IT-M, M] (SA B1); *Elymus transhyrcanus* (Nevski) Tzvelev [H, IT-ES, Pa] (SA B40); *Eremopoa altaica* (Trin.) Roshev. [T, IT-M, Pa] (SA G16); *Eremopyrum bonaepartis* (Spreng.) Nevski [T, IT] (SA G4); *Henrardia persica* (Boiss.) C.E.Hubb. [T, IT, Pa] (SA B69); *Hordeum brevisubulatum* (Trin.) Link. [H, IT, Pa, Po] (SA G2); *Melica persica* Kunth [H, IT, Pa] (SA G13); *Piptatherum molinioides* Boiss. [H, IT, DD] (SA G3); *Poa bulbosa* L. [G, IT-ES-M, Pa] (SA B3); *Psathyrostachys fragilis* (Boiss.) Nevski [H, IT-ES, Pa] (SA B43); *Stipa barbata* Desf. [H, IT, Pa, M] (SA C20); *Taeniatherum caput-medusae* (L.) Nevski [T, IT-SS-M, Pa] (SA G5). **Primulaceae** Batsch ex Borkh.: *Lysimachia maritima* (L.) Galasso, Banfi & Soldano [H, Pl, M, *****] (SA G9). **Ranunculaceae** Juss.: *Anemone biflora* DC. [H, Pl, Pa, Po, M] (SA F4); *Ranunculus scelerantus* L. [H, COSM, Po, M] (SA B31); *Thalictrum sultanabadense* Stapf [H, IT-M, En] (SA B24). **Rhamnaceae** Juss.: *Rhamnus persica* P. Lawson [Ph, IT, En, LR, M] (SA C25). **Rosaceae** Juss.: *Cerasus chorassanica* Pojark. [Ph, IT, En, LR, M,*****] (SA B49); *Prunus orientalis* (Mill.) Koehne [Ph, IT, Po, M] (SA B51); *Rosa beggeriana* Schrenk ex Fisch. & C.A.Mey. [Ph, IT, M] (SA D15); *Sanguisorba minor* Scop. [H, IT-ES-M, Pa, M] (SA C1). **Rubiaceae** Juss.: *Asperula setosa* Jaub. & Spach [T, IT] (SA B5); *Callipeltis cucualris* Stev. [T, IT-M, En] (SA C28); *Cruciata taurica* (Pall. ex Willd.) Ehrend. [H, IT] (SA A4); *Galium tricornutum* Dandy [T, IT-M, M] (SA B13); *Galium verum* L. [H, IT-ES, Pa, M] (SA D11). **Rutaceae** Juss.: *Haplophyllum lissonotum* C.C.Towns. [H, IT, En, M] (SA D154); *Haplophyllum perforatum* Kar. & Kir. [H, IT-SS, M, *****] (SA D27). **Salicaceae** Mirb.: *Salix acmophylla* Boiss. [Ph, IT-M, M] (SA B58); *Salix alba* L. [Ph, IT, M] (SA G19). **Santalaceae** R.Br.: *Thesium kotschyanum* Boiss. [T, IT-SS, M] (SA G8). **Scrophulariaceae** Juss.: *Scrophularia leucoclada* Bunge [Ch, IT] (SA A5); **Thymelaeaceae** Juss.: *Daphne mucronata* Royle [Ph, IT, M] (SA D5). **Urticaceae** Juss.: *Parietaria judaica* L. [H, IT-ES-M, M] (SA B35). **Xanthorrhoeaceae** Dum.: *Eremurus persicus* (Jaub. & Spach) Boiss. [G, IT, VU, Pa] (SA B7).

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[DOR: 20.1001.1.24236330.1397.5.3.6.8]
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