

## A checklist of vascular plants of the Sorkhabad Protected Area, Zanjan Province, NW Iran

Leila Moghanloo<sup>1</sup>, Farrokh Ghahremaninejad<sup>2\*</sup>, Akbar Norastehnia<sup>3</sup>, Mahmoud Bidarlord<sup>4</sup>

1. Department of Biology, Faculty of Sciences, University of Zanjan, Zanjan, Iran

2. Department of Plant Sciences, Faculty of Biological Sciences, Kharazmi University, Tehran, Iran

3. Department of Biology, Faculty of Sciences, University of Guilan, Rasht, Iran

4. Department of Forests and Rangelands Research, Guilan Agricultural & Natural Resources Research and Education Center, Agricultural Research, Education and Extension Organization (AREEO), Rasht, Iran

\* Corresponding author's Email: fgh@khu.ac.ir

### ABSTRACT

This study aimed to provide the first floristic checklist from Sorkhabad Protected Area in Zanjan Province, Northwest Iran. This area is one of the large protected areas in the Irano-Anatolian global biodiversity hotspot. This study was conducted based on the extensive field surveys during the growing season from 2019 to 2021. Our results documented 523 taxa of vascular plants belonging to 290 genera and 70 families. The most prominent families are Asteraceae (44 genera, 66 species), Brassicaceae (24 genera, 36 species), Poaceae (21 genera, 38 species) and Fabaceae (17 genera, 44 species). The richest genera are *Astragalus* L. (19 species), *Bromus* L., *Papaver* L., *Salvia* L. and *Silene* L. (each with 7 species), *Allium* L., *Centaurea* L., and *Glaucium* Mill. (each with 6 species). Hemicryptophytes (218 taxa, 42%) are the most dominant life form followed by therophytes (162 taxa, 31%), and Irano-Turanian elements (296 taxa, 57%) are the most common plants. Current results provide baseline data for future studies, such as conservation, and phytogeography.

**Keywords:** Floristic diversity, Qezel Ozan River, Irano-Anatolian, Qaflankoh Mountains, Zanjanrood River.

**Article type:** Research Article.

### INTRODUCTION

Protected areas are key strategies for conserving nature and halting the loss of biodiversity (Geldmann *et al.* 2019) and represent ecosystems valuable for the conservation of populations of native species and their habitats (Esina & Khapugin 2022). These areas are considered the primary defenses against biodiversity loss, provided they are well-maintained and managed (Heywood 2019). According to the latest Protected Planet Report, by 2020, at least 17% of terrestrial and inland waters will be conserved through protected areas. In Iran, 309 regions (10.36% of the country's total area) are under conservation management, including 32 national parks, 53 wildlife refuges, 40 national natural monuments, and 184 protected areas (Parchizadeh & Belant 2021). Two protected areas are located in Zanjan Province including Anguran and Sorkhabad. Sorkhabad Protected Area (SPA), which has been managed and protected since 1997, is situated northwest of Zanjan City. It is located in the Irano-Anatolian global biodiversity hotspot (Moghanloo *et al.* 2023) which covers an area of about 899,773 km<sup>2</sup>, and its considerable part is found in Northwestern Iran. It is a World Heritage Site known for its rich biodiversity, with about 6,000 plant species. Floristic inventory is a beneficial data source for biogeographical, ecological, and evolutionary surveys that provide suitable information for decision-making processes in biodiversity conservation and landscape projecting (Carta *et al.* 2018). By identifying the flora of different areas and comparing their diversity, the vegetation potential of the areas will be determined for more conservation programs (Saberamoli *et al.* 2021). Therefore, in Iran, as in other parts of the world, the floristic study in different regions has always been of focus of botanists (Mahmoodi *et al.* 2022). A few contributions to the floristic studies in adjacent protected areas,

including Arasbaran (Assadi 1988); Marakan (Ghahremaninejad & Nafisi 2011); Lissar (Ghahremaninejad *et al.* 2012) and Aq-Dagh (Molayi Shamasbi *et al.* 2021), have been published with an initial focus on the floristic composition of the protected areas and also on specific taxa. This study aims to provide the first checklist of the vascular plants in the SPA. Such floristic studies, in addition to investigating the plant diversity of a protected area, help to improve the knowledge of the flora in Zanzan Province. So far, several floristic studies have been conducted in different parts of Zanzan Province. The most important of which include: “Final report of a research project of collection and identification of plants of Zanzan Province and establishment of herbarium” (Musavi 2000), “An introduction of flora and phytogeographical elements of Khanchay Watershed in Tarome-olya of Zanzan” (Musavi 2004), “A study of the floristic composition, life form, and chorology of plants in three areas of Abhar County, southeast of Zanzan Province” (Vafadar *et al.* 2017) and, “Diversity of vascular plants in Damirli Mountains, Zanzan Province, NW of Iran” (Mahmoodi *et al.* 2022). The results of these studies indicate the great plant diversity and species richness in this province. Another study entitled “Diversity and distribution of endemic & threatened plant species in the Sorkhabad Protected Area, Zanzan, NW Iran, and identification of the biodiversity hotspots in the area” (Moghanloo *et al.* 2023) has also been conducted. This study, which is complementary to the present study, presents 141 plant species in this area, endemic to Iran or threatened species. In addition, the state of their population and their distribution in the western and eastern halves of the SPA have been comprehensively investigated.

## MATERIALS AND METHODS

### The study area

#### Geography and climate

Sorkhabad Protected Area (SPA), with a 122,618 ha situated between the geographical coordinates 36°44' to 37°08' N and 48°04' to 48°46' E. This area is located in the two counties, i.e., Zanzan and Tarom in Zanzan Province. There are many villages in this area. The boundary of SPA is determined between the two valleys of the Qezel Ozan River and Zanzanrood River. Fig. 1 illustrates SPA location in Zanzan Province, Iran. Based on geomorphological and field surveys, SPA mainly includes mountainous areas, Mahori hills, and plains. Most villages are located on Mahori hill and plains between mountain ranges. Regarding tectonics, most of the heights of the area are in the continuity of the Alborz Mountain range and include part of the Qaflankoh Mountains range. It is separated from Talesh Mountains by the Qezel Ozan River valley. The mountains of this area are mainly composed of volcanic rocks that have undergone tectonic changes. The elevation varies from 400 to 3000 meters above sea level (m.a.s.l.). Most of the area is located in the 1000 to 2200 m.a.s.l. The soil of the area often has a deep, loamy texture with 18% granular gravel and medium strength. The rate of permeability and erosion of soil is average; they do not have a limiting layer and have organic matter in the amount of 0.85%-1%. The climate of the area is the result of meteorological phenomena and is influenced by topographical factors, altitude, and the extent of plain lands. In the west, northwest, and south of the region, a cold semi-arid climate prevails; in the northeastern region, a cold semi-humid climate prevails. The cold and semi-humid climate of the northeastern region has a Caspian origin due to its border with Guilan Province and the effects of the humidity of the Caspian region and a part of the central and western Alborz highlands. The dominant climate type is the cold semi-arid region, which covers over 70% of the area.

#### Vegetation

The vegetation and habitats of the studied area is very diverse because of the vastness of the area and variety of topography and climate. In the western half, the area begins with mountainous steppe habitats with the distribution of plants such as *Rosa persica* Michaux ex Juss., *Eremopyrum bonaepartis* (Spreng.) Nevski, *Alyssum dasycarpum* Stephan ex Willd., *Senecio glaucus* L., *Geranium kotschyi* Boiss., *Eremurus kopet-daghensis* Karrer, and the scattered shrubs of *Tamarix ramosissima* Ledeb. and *Salix acmophylla* Boiss. around the Zanzanrood River, which continues to the plains in the center of the area and in the surrounding residential zones, seen as ruderal or segetal habitats. By advancing towards the heights of Qaflankoh Mountains, we can see torn cushion steppe habitats with plants such as *Acantholimon asphodelinum* Mobayen, *Astragalus microcephalus* Willd. and in humid regions, scattered shrubs of species of *Rosa* L. and *Prunus* L. and perennial grasses are distributed in most of the slopes. At altitudes above 2400 m.a.s.l., especially in the north of the area, there are the snow beds habitats with plants such as *Puschkinia scilloides* Adams. In the heights of Qaflankoh Mountains towards the east of the area, which is more humid and warmer, the habitats of tree and shrub with plants such as *Paliurus spina-christi* Mill., *Pistacia*

*atlantica* Desf., *Acer monspessulanum* L., *Punica granatum* L., *Cotoneaster* spp., *Rubus sanctus* Kuntze, *Ficus carica* L., *Crataegus* spp., *Juniperus excelsa* M.Bieb., are densely distributed, especially in deep valleys along the rivers. Between the heights of Qaflankoh Mountains and the Qezel Ozan River, we can see dense and diverse covers of vegetation with plants such as *Papaver* spp., *Calendula arvensis* L., *Cleome rupicola* Vicary, and *Gundelia tournefortii* L. Finally, along the bank of the Qezel Ozan River, which is the eastern border of the area, shrubs such as *Populus euphratica* Olivier, *Pistacia atlantica*, and *Punica granatum* grows more.

## Methods

The floristic research was carried out during the growing seasons from 2019 to 2021. A total of 32 field trips in 95 stations were performed for sampling. Plots with random distribution and approximate sizes of 100 to 200 m<sup>2</sup> were established in each station according to the possibility of access, and the specimens of vascular plant taxa were collected. The exact location and altitude were determined using GPS. Some stations were visited several times, most at least twice a year. In the southern and southwestern parts of the area, there was no possibility for sampling due to the airport, military zone, and a number of mines and factories. Taxa were identified according to the Flora of Iran (Assadi 1988\_2024), Flora Iranica (Rechinger et al. 1963\_2015), Flora of Turkey (Davis 1965\_1988), Flora of Iraq (Townsend et al. 1966\_1974) and monographs published after these floras (such as *Ornithogalum*, Bidarlord & Ghahremaninejad 2016; *Phleum*, El-Gazzar et al. 2016; *Bromus* et al. 2015; *Scorzonera*, Norouzi et al. 2016; Solanaceae, Eskandari & Shirzadian 2022). The taxa families were defined based on the latest phylogenetic classification changes, such as APG IV. Also, the scientific names of species and their authors were applied based on reliable sources such as The Plant List (theplantlist.org) and Plants of the World Online, POWO (powo.science.kew.org). The chorology of species is based on Zohary (1973), Takhtajan (1986), White & Leonard (1999), and Flora of Iran (Assadi et al. 1988\_2024). Life form was categorized according to Raunkiaer (1934) as follows: Ch (Chamaephyte), Ge (Geophyte), He (Hemicryptophyte), Ph (Phanerophyte), and Th (Therophyte). All specimens were housed in the herbarium of Kharazmi University (T), Tehran, Iran.

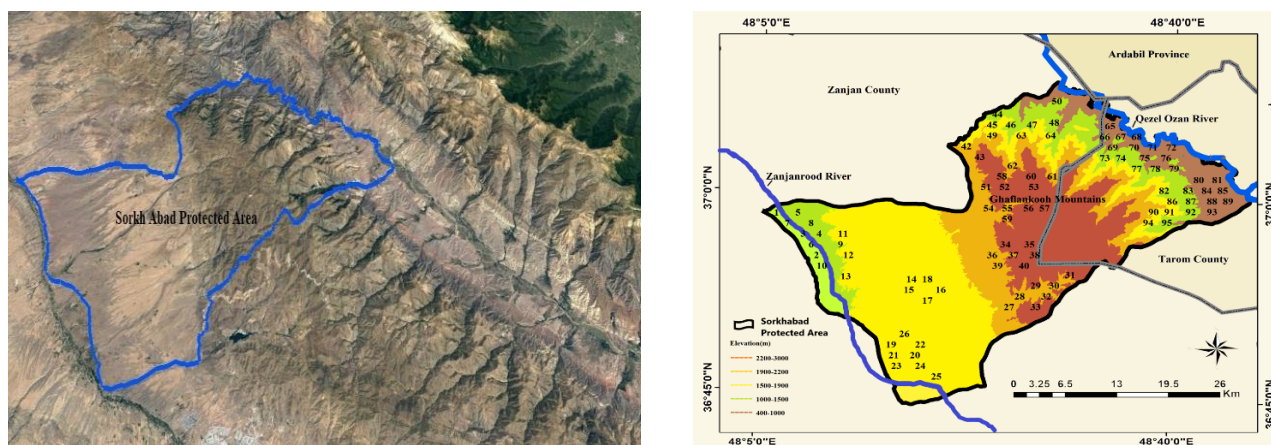
## RESULTS

### Floristic composition

A total of 523 taxa of vascular plants (including 499 species, 16 subspecies, and seven varieties) belonging to 290 genera within 70 families were collected and determined from SPA. Due to the presence of an airport and many residential regions, mines, gardens, and private agricultural lands, sampling was only allowed in a few places, and the natural vegetation of the regions was destroyed. Table 1 shows the checklist of vascular plants of SPA, and Figs. 2-9 are related to some of these taxa. In total, the vascular flora checklist of the SPA included 83.2% eudicots, 15.1% monocots, 0.9% gymnosperms, and 0.8% ferns. Regarding families, three and two families were ferns and gymnosperms, respectively. Angiosperms belonged to 65 families, with 11 monocots and 54 eudicots (Table 2).

### Life forms, elevational distribution, and phytogeography

Regarding the life form spectrum in this area, the majority of plant species (217 taxa, 42%) were adapted to cold semi-arid conditions as hemicryptophytes, followed by therophytes (161 taxa, 31%), geophytes (71 taxa, 14%), chamaephytes (38 taxa, 7%), and phanerophytes (35 taxa, 6%). Chamaephytes, such as suffruticose or thorny cushions, made relatively low contributions to the life form spectrum in this area. In relation to elevational distribution, 63% (329 number) of the species are distributed in mid-elevation zones (1000 to 1600 m and 1600 to 2200 m), which are the most zones in this area, 23% (120 number) in lowlands (400 to 1000 m) and 14% (73 number) in high elevations (2200 to 3000 m). Regarding phytogeography, about 57% (296 species) belonged to the Irano-Turanian floristic region, and 21% (109 species) were shared between Irano-Turanian and other regions. The rest of the species (117 species, 22%) are Pluriregional or Cosmopolitan, which are distributed in three or more phytogeographical regions (Fig. 10).



a



b

**Fig. 1a.** Satellite and geological map (The numbers show the stations of sampling) of Sorkhabad Protected Area. **b.** A view of the habitat and Qezel Ozan River in the eastern of SPA.

**Table 1.** Checklist of vascular plant species in the SPA (in alphabetical order). Life forms: Ph (Phanerophyte), Ch (Chamaephyte), He (Hemicryptophyte), Ge (Geophyte), and Th (Therophyte). Phytogeographical regions (Phyto regions): IT (Irano-Turanian), ES (Euro-Siberian), M (Mediterranean), SS (Shaharo-Sindian), PI (Pluriregional), Cos (Cosmopolitan). T (Herbarium of Kharazmi University).

Families and Species	Life form	Phyto regions	Elevation (m.a.s.l.)	Voucher number
<b>Amaranthaceae</b>				
1. <i>Atriplex aucheri</i> Moq.	Th	IT-ES	1315	23270 (T)
2. <i>Ceratocarpus arenarius</i> L.	Th	IT	1312	23911 (T)
3. <i>Dysphania botrys</i> (L.) Mosyakin & Clemants	Th	PL	2240	23802 (T)
4. <i>Halimocnemis malacophylla</i> (M.Bieb.) C.A.Mey.	Th	IT	1298–1309	23707 (T)
5. <i>Oxybasis rubra</i> (L.) S.Fuentes, Uotila & Borsch	Th	IT	1295	23267 (T)
6. <i>Salsola kali</i> L.	Th	IT	2138	23790 (T)

7.	<i>Spinacia tetrandra</i> Steven ex M.Bieb.	Th	IT	1315	23268 (T)
<b>Amaryllidaceae</b>					
8.	<i>Allium akaka</i> S.G.Gmel. ex Schult. & Schult.f.	Ge	IT	2473	23526 (T)
9.	<i>Allium dictyoprasum</i> C.A.Mey. ex Kunth	Ge	IT	1299	24191 (T)
10.	<i>Allium materculae</i> Bordz.	Ge	IT	1295	23265 (T)
11.	<i>Allium phaneranthum</i> Boiss. & Hausskn.	Ge	IT	724	24145 (T)
12.	<i>Allium scabriscapum</i> Boiss.	Ge	IT	637–1307	23619 (T)
13.	<i>Allium shelkovnikovii</i> Grossh.	Ge	IT	1875	23424 (T)
<b>Anacardiaceae</b>					
14.	<i>Pistacia atlantica</i> Desf.	Ph	IT	707–1061	23604 (T)
<b>Apiaceae</b>					
15.	<i>Anthriscus cerefolium</i> (L.) Hoffm.	Th	IT-M	908–1293	23303 (T)
16.	<i>Astrodaucus persicus</i> (Boiss.) Drude	He	IT	1980	23249 (T)
17.	<i>Bunium rectangulum</i> Boiss. & Hausskn.	Ge	IT	2175	23671 (T)
18.	<i>Bupleurum lancifolium</i> Hornem.	Th	IT	530–1573	23183 (T)
19.	<i>Cymbocarpum anethoides</i> DC. ex C.A.Mey.	Th	PL	592–2009	23602 (T)
20.	<i>Chaerophyllum macropodum</i> Boiss.	He	IT	1298	23927 (T)
21.	<i>Echinophora platyloba</i> DC.	He	IT	1980	23997 (T)
22.	<i>Eryngium billardierei</i> F.Delaroche	He	IT	2138	24051 (T)
23.	<i>Eryngium caeruleum</i> M.Bieb.	He	IT-M	2090	23657 (T)
24.	<i>Eryngium glomeratum</i> Lam.	He	IT	2138	23785 (T)
25.	<i>Eryngium noeanum</i> Boiss.	He	IT	1360	23827 (T)
26.	<i>Falcaria vulgaris</i> Bernh.	He	PL	2152	23387 (T)
27.	<i>Ferula oopoda</i> (Boiss. & Buhse) Boiss.	He	IT	1106	23678 (T)
28.	<i>Ferula ovina</i> Boiss.	He	IT	1295	23264 (T)
29.	<i>Grammosciadium platycarpum</i> Boiss. & Hausskn.	He	IT	2085–2493	23364 (T)
30.	<i>Heracleum persicum</i> Desf. ex Fisch., C.A.Mey. & Avé-Lall.	He	IT	1307–2493	23665 (T)
31.	<i>Laser carduchorum</i> (Hedge & Lamond) Wojew. & Spalik	He	IT	1992	23510 (T)
32.	<i>Prangos uloptera</i> DC.	He	PL	2090	23670 (T)
33.	<i>Scandix iberica</i> M.Bieb.	Th	IT	2085	23231 (T)
34.	<i>Scandix stellata</i> Banks & Sol.	Th	IT-M	1106–1875	23953 (T)
35.	<i>Smyrniopsis aucheri</i> Boiss.	He	IT	2090	23668 (T)
36.	<i>Smyrnum cordifolium</i> Boiss.	He	IT	1875	23413 (T)
37.	<i>Torilis arvensis</i> subsp. <i>neglecta</i> (Schult.) Thell.	Th	IT	592	23677 (T)

38.	<i>Torilis leptophylla</i> (L.) Rchb.f.	Th	IT-ES	1366	23221 (T)
39.	<i>Turgenia latifolia</i> (L.) Hoffm.	Th	IT-M	2175	23216 (T)
<b>Apocynaceae</b>					
40.	<i>Cynanchum acutum</i> L.	He	PL	637	23606 (T)
41.	<i>Vinca herbacea</i> Waldst. & Kit.	He	PL	980–2148	23206 (T)
<b>Asparagaceae</b>					
42.	<i>Muscari caucasicum</i> (Griseb.) Baker	Ge	IT	1285–1353	23160 (T)
43.	<i>Muscari neglectum</i> Guss. ex Ten.	Ge	PL	538–2493	23141 (T)
44.	<i>Ornithogalum boissieri</i> Bidarlord & F.Ghahrem.	Ge	IT	2212	24178 (T)
45.	<i>Ornithogalum cuspidatum</i> Bertol.	Ge	IT	2129	23385 (T)
46.	<i>Ornithogalum narbonense</i> L.	Ge	IT	908	23478 (T)
47.	<i>Ornithogalum oligophyllum</i> E.D.Clarke	Ge	IT-M	1664–2207	23489 (T)
48.	<i>Ornithogalum orthophyllum</i> Ten.	Ge	IT	1875	23418 (T)
49.	<i>Puschkinia scilloides</i> Adams	Ge	IT	2493	23532 (T)
<b>Asteraceae</b>					
50.	<i>Achillea setacea</i> Waldst. & Kit.	He	IT	1504	23956 (T)
51.	<i>Achillea tenuifolia</i> Lam.	He	IT	1360	23825 (T)
52.	<i>Achillea vermicularis</i> Trin.	He	PL	2207	23562 (T)
53.	<i>Achillea wilhelmsii</i> K.Koch	He	IT	1315	23269 (T)
54.	<i>Amberboa sosnovskyi</i> Iljin	He	IT	1307–2028	23915 (T)
55.	<i>Anthemis haussknechtii</i> Boiss. & Reut.	Th	IT	592	23598 (T)
56.	<i>Anthemis hyalina</i> DC.	Th	IT	1621	23409 (T)
57.	<i>Arctium lappa</i> L.	He	IT-ES	1504	23980 (T)
58.	<i>Artemisia incana</i> Druce	He	IT-M	1518	23260 (T)
59.	<i>Calendula arvensis</i> L.	Th	IT-SS	746–1518	23139 (T)
60.	<i>Callicephalus nitens</i> (M.Bieb. ex Willd.) C.A.Mey.	Th	PL	1170	23933 (T)
61.	<i>Carduus pycnocephalus</i> L.	Th	IT	479	23166 (T)
62.	<i>Carthamus oxyacanthus</i> M.Bieb.	Th	IT	2138	23926 (T)
63.	<i>Centaurea assadii</i> Ranjbar & Negaresh	He	IT	2292	23921 (T)
64.	<i>Centaurea benedicta</i> (L.) L.	Th	IT	503	23177 (T)
65.	<i>Centaurea bruguierana</i> (DC.) Hand.-Mazz.	Th	PL	674	23828 (T)
66.	<i>Centaurea calcitrapa</i> L.	He	IT-ES	1293	23298 (T)
67.	<i>Centaurea depressa</i> M.Bieb.	Th	IT	1138	23289 (T)

68.	<i>Centaurea virgata</i> Lam.	He	IT	637–2138	23787 (T)
69.	<i>Chardinia orientalis</i> (L.) Kuntze	Th	IT	1299–1875	23916 (T)
70.	<i>Cicerbita microcephala</i> (DC.) M.Güzel, Coşkunç. & N.Kilian	Ge	IT	1106	23455 (T)
71.	<i>Cichorium intybus</i> L.	He	Cos	1504	23966 (T)
72.	<i>Cichorium pumilum</i> Jacq.	Th	IT	555	23137 (T)
73.	<i>Cirsium arvense</i> var. <i>vestitum</i> Wimm. & Grab.	He	IT	1504	23983 (T)
74.	<i>Cota triumfetti</i> (L.) J.Gay	He	IT	479–1518	23148 (T)
75.	<i>Cousinia chrysacantha</i> Jaub. & Spach	He	IT	538	23991 (T)
76.	<i>Cousinia lepida</i> (Bunge ex) Boiss.	He	IT	566	23981 (T)
77.	<i>Cousinia seidlitzii</i> Bunge	He	IT	2529	23994 (T)
78.	<i>Crepis sancta</i> (L.) Bornm.	Th	PL	1293	23155 (T)
79.	<i>Crupina vulgaris</i> Pers. ex Cass.	Th	IT-M	1106	23461 (T)
80.	<i>Echinops acantholepis</i> Jaub. & Spach	Th	IT	1298	23919 (T)
81.	<i>Echinops haussknechtii</i> Boiss.	He	IT	2138	23783 (T)
82.	<i>Filago desertorum</i> Pomel	Th	PL	479–746	23147 (T)
83.	<i>Gelasia cinerea</i> (Boiss.) Zaika, Sukhor. & N.Kilian	He	IT-M	1366	23924 (T)
84.	<i>Gundelia tournefortii</i> L.	He	IT	1274–1293	23306 (T)
85.	<i>Helichrysum arenarium</i> subsp. <i>rubicundum</i> (K.Koch) P.H.Davis & Kupicha	He	IT	1106	23445 (T)
86.	<i>Helichrysum graveolens</i> (M.Bieb.) Sweet	He	IT-M	2442	23794 (T)
87.	<i>Helichrysum oligocephalum</i> DC.	He	IT	1980	23293 (T)
88.	<i>Inula aucheriana</i> DC.	Ge	PL	2240	23803 (T)
89.	<i>Inula helenium</i> L.	Ge	PL	2240	23808 (T)
90.	<i>Inula peacockiana</i> (Aitch. & Hemsl.) Korovin	Ch	IT	1980	23985 (T)
91.	<i>Jurinea carduiiformis</i> (Jaub. & Spach) Boiss.	He	PL	592–637	23600 (T)
92.	<i>Koelpinia linearis</i> Pall.	Th	Cos	1307–1323	23922 (T)
93.	<i>Lactuca orientalis</i> (Boiss.) Boiss.	He	IT	1504	23952 (T)
94.	<i>Lactuca seriola</i> L.	He	PL	1504	23954 (T)
95.	<i>Lactuca takhtadzhianii</i> Sosn.	Ge	IT	707	23590 (T)
96.	<i>Lophiolepis haussknechtii</i> (Boiss.) Bureš, Del Guacchio, Iamónico & P.Caputo	He	IT	2138	23786 (T)
97.	<i>Matricaria aurea</i> (Loefl.) Sch.Bip.	Th	IT	2275	23520 (T)
98.	<i>Oligochaeta tomentosa</i> Czerep.	Th	IT	1299	23918 (T)
99.	<i>Picnomon acarna</i> (L.) Cass.	Th	IT-M	2138	23784 (T)
100.	<i>Psephellus gilanicus</i> (Bornm.) Wagenitz	He	IT	1307–2292	23923 (T)
101.	<i>Pseudopodospermum papposum</i> (DC.) Zaika, Sukhor. & N.Kilian	He	IT-SS	1293	23315 (T)
102.	<i>Pseudopodospermum tunicatum</i> (Rech.f. & Köie) E.Hatami, N.Kilian & K.E.Jones	He	IT	1295–2217	23253 (T)
103.	<i>Rhaponticum repens</i> (L.) Hidalgo	He	IT	1504	23292 (T)

104. <i>Sclerorhachis platyrachis</i> (Boiss.) Podlech ex Rech.f.	He	IT-ES	2090	23658 (T)
105. <i>Senecio glaucus</i> L.	Th	PL	519	23229 (T)
106. <i>Siebera nana</i> (DC.) Bornm.	Th	IT	2028	23920 (T)
107. <i>Sonchus asper</i> (L.) Hill	He	IT-M	530	23184 (T)
108. <i>Tanacetum polycephalum</i> Sch.Bip.	He	IT-M	637–2218	23388 (T)
109. <i>Taraxacum juzepczukii</i> Schischk.	He	IT	2493	24103 (T)
110. <i>Taraxacum syriacum</i> Boiss.	He	IT	1504	23947 (T)
111. <i>Tragopogon graminifolius</i> DC.	He	IT-M	1504	23946 (T)
112. <i>Tragopogon porphyrocephalus</i> Rech.f.	He	IT	2218	23914 (T)
113. <i>Tussilago farfara</i> L.	Ge	PL	1504	23136 (T)
114. <i>Xanthium spinosum</i> L.	Th	IT-ES	2138	23781 (T)
115. <i>Xeranthemum annuum</i> L.	He	IT	592	23599 (T)
<b>Berberidaceae</b>				
116. <i>Berberis integerrima</i> Bunge	Ph	IT	1992	23495 (T)
117. <i>Bongardia chrysogonum</i> (L.) Spach	Ge	IT	1274–1293	23203 (T)
118. <i>Leontice armeniaca</i> Boivin	Ge	IT	1310–1353	23159 (T)
<b>Biebersteiniaceae</b>				
119. <i>Biebersteinia multifida</i> DC.	Ge	IT	2232	23396 (T)
<b>Boraginaceae</b>				
120. <i>Anchusa azurea</i> Mill.	He	IT-M	2175	23673 (T)
121. <i>Anchusa strigosa</i> subsp. <i>strigosa</i>	He	IT	1980	23297 (T)
122. <i>Arnebia decumbens</i> (Vent.) Coss. & Kralik	Th	IT-ES	479	23170 (T)
123. <i>Arnebia hispidissima</i> (Sieber ex Lehm.) A.DC.	Th	IT	1417–1518	23245 (T)
124. <i>Buglossoides arvensis</i> (L.) I.M.Johnst.	Th	PL	1498	23540 (T)
125. <i>Buglossoides incrassata</i> (Guss.) I.M.Johnst.	He	IT-ES	1518	23236 (T)
126. <i>Caccinia macranthera</i> (Banks & Sol.) Brand	Th	IT-M	1298	23157 (T)
127. <i>Cerintho minor</i> L.	He	PL	975	24105 (T)
128. <i>Echium italicum</i> L.	He	IT-M	698	23705 (T)
129. <i>Heliotropium dissitiflorum</i> Boiss.	Th	PL	535–637	23577 (T)
130. <i>Lappula microcarpa</i> (Ledeb.) Gürke	Th-He	PL	1082	23274 (T)
131. <i>Lappula squarrosa</i> (Retz.) Dumort.	Th	IT-M	1108	23982 (T)
132. <i>Lithospermum officinale</i> L.	Ge	IT-M	1012	24113 (T)
133. <i>Moltkia coerulea</i> (Willd.) Lehm.	Ge	IT	956	24078 (T)



134. <i>Myosotis ramosissima</i> Rochel ex Schult.	Th	IT-M	2234	23555 (T)
135. <i>Nonea caspica</i> (Willd.) G.Don	Th	IT-M	815	23140 (T)
136. <i>Nonea persica</i> Boiss.	Th	IT	746	23146 (T)
137. <i>Nonea pulla</i> (L.) DC.	Th	PL	479	23165 (T)
138. <i>Nonea rosea</i> (M.Bieb.) Link	Th	IT-M	746	23142 (T)
139. <i>Onosma bulbotricha</i> DC.	He	IT	1324	23329 (T)
140. <i>Onosma microcarpa</i> Steven ex DC.	He	IT	1082	23275 (T)
141. <i>Onosma sericea</i> Willd.	He	IT	918	23591 (T)
142. <i>Paracaryum strictum</i> (K.Koch) Boiss.	He	IT	1106	23448 (T)
143. <i>Pseudoheterocaryum rigidum</i> (A.DC.) Kaz.Osaloo & Saadati	He	IT	1315	23144 (T)
144. <i>Rochelia disperma</i> (L.f.) K.Koch	Th	IT	1992	23501 (T)
145. <i>Rochelia persica</i> Bunge ex Boiss.	Th	IT-M	1820	23972 (T)
146. <i>Suchtelenia macrocarpa</i> (Zakirov) Sennikov	He	IT	746	23294 (T)
<b>Brassicaceae</b>				
147. <i>Aethionema arabicum</i> (L.) Andr. ex DC.	Th	IT	1295	23426 (T)
148. <i>Aethionema carneum</i> (Banks & Sol.) B.Fedtsch.	Th	IT	1295–1309	23984 (T)
149. <i>Aethionema grandiflorum</i> Boiss. & Hohen.	Ch	IT	925	23196 (T)
150. <i>Aethionema membranaceum</i> DC.	Ch	IT	1008	23291 (T)
151. <i>Alliaria petiolata</i> (M.Bieb.) Cavara & Grande	He	PL	908–1293	23304 (T)
152. <i>Alyssum dasycarpum</i> Stephan ex Willd.	Th	PL	1295	23252 (T)
153. <i>Alyssum stapfii</i> Vierh.	Th	IT-M	1992	23513 (T)
154. <i>Arabis nova</i> Vill.	Th	IT	1366	23557 (T)
155. <i>Barbarea brachycarpa</i> subsp. <i>minor</i> (K.Koch) Parolly & Eren	He	IT	2212	23931 (T)
156. <i>Barbarea plantaginea</i> DC.	He	IT-M	2212–2020	23551 (T)
157. <i>Camelina rumelica</i> subsp. <i>transcaspica</i> (Fritsch) Hedge	He	IT-M	1366	23904 (T)
158. <i>Capsella bursa-pastoris</i> (L.) Medik.	Th	PL	1992	23504 (T)
159. <i>Chorispora persica</i> Boiss.	Th	IT	1138	23295 (T)
160. <i>Clastopus vestitus</i> (Desv.) Boiss.	He	IT	2473–2529	23529 (T)
161. <i>Conringia orientalis</i> (L.) C.Presl	He	IT	908	23480 (T)
162. <i>Descurainia sophia</i> (L.) Webb ex Prantl	He	PL	1012	23551 (T)
163. <i>Diplotaxis harra</i> (Forssk.) Boiss.	He	PL	746	23150 (T)
164. <i>Erysimum caespitosum</i> DC.	Ch	IT-M	1295	23635 (T)
165. <i>Erysimum gelidum</i> Bunge	Th	IT	1138–2473	23519 (T)
166. <i>Erysimum repandum</i> L.	Th	IT-M	2473	23521 (T)
167. <i>Erysimum scabrum</i> DC.	Th	IT	1875	23282 (T)
168. <i>Goldbachia laevigata</i> DC.	Th	IT	2020	23555 (T)

169. <i>Hesperis persica</i> Boiss.	He	IT	2009	23187 (T)
170. <i>Hirschfeldia incana</i> (L.) Lagr.-Foss.	He	PL	637–698	23576 (T)
171. <i>Isatis cappadocica</i> Desv.	He	PL	1875	23457 (T)
172. <i>Lepidium draba</i> L.	He	IT-ES	1138–1875	23288 (T)
173. <i>Lepidium latifolium</i> L.	Th	IT	1504	23971 (T)
174. <i>Matthiola longipetala</i> (Vent.) DC.	Th	IT-SS	777	23152 (T)
175. <i>Matthiola ovatifolia</i> Boiss.	Ch	IT	1992	23509 (T)
176. <i>Meniocus linifolius</i> (Stephan ex Willd.) DC.	Th	IT-M	2473	23527 (T)
177. <i>Meniocus meniocooides</i> (Boiss.) Hadač & Chrtek	Th	PL	1295–1518	23237 (T)
178. <i>Nasturtium officinale</i> W.T.Aiton	He	IT-M	1293–2020	23301 (T)
179. <i>Pseudocamelina glaucophylla</i> (DC.) N.Busch	He	IT	535	23582 (T)
180. <i>Sterigmostemum incanum</i> M.Bieb.	He	IT	592	23597 (T)
181. <i>Strigosella africana</i> (L.) Botsch.	Th	PL	1417	23243 (T)
182. <i>Strigosella scorpioides</i> (Bunge.) Botsch.	Th	IT	1309	23929 (T)
<b>Capparaceae</b>				
183. <i>Capparis spinosa</i> L.	Ph	PL	555	23570 (T)
<b>Caprifoliaceae</b>				
184. <i>Cephalaria microcephala</i> Boiss.	He	IT	2442	23797 (T)
185. <i>Lomelosia calocephala</i> (Boiss.) Greuter & Burdet	Th	IT	674	24129 (T)
186. <i>Scabiosa columbaria</i> L.	He	IT-ES	1106–1170	23643 (T)
187. <i>Valeriana coronata</i> (L.) Mill.	He	IT-SS	1123	24061 (T)
188. <i>Valeriana cymbaearpa</i> (C.A.Mey.) Sennikov	Th	IT	1295–1309	23450 (T)
189. <i>Valeriana leucophaea</i> DC.	Ge	IT	1875	23441 (T)
190. <i>Valeriana sisymbriifolia</i> Vahl	He	IT	1366	23932 (T)
191. <i>Valeriana orientalis</i> (DC.) Sennikov	Th	IT	1309–1417	23142 (T)
192. <i>Valeriana oxyrhyncha</i> (Fisch. & C.A.Mey.) Christenh. & Byng	Th	IT-M	1295	23266 (T)
193. <i>Valeriana szovitsiana</i> (Fisch. & C.A.Mey.) Christenh. & Byng	Th	IT	1298	23928 (T)
194. <i>Valerianella chlorostephana</i> Boiss. & Balansa	He	IT	1573	23335 (T)
<b>Caryophyllaceae</b>				
195. <i>Acanthophyllum crassifolium</i> Boiss.	Ch	IT	2171	23979 (T)
196. <i>Bufoia macrocarpa</i> Ser.	He	IT	1324	23505 (T)
197. <i>Cerastium inflatum</i> Gren.	Th	IT	2085–2275	23365 (T)
198. <i>Cerastium perfoliatum</i> L.	Th	IT-M	1875	23440 (T)

199. <i>Dianthus orientalis</i> subsp. <i>gorganicus</i> Rech.f.	He	IT	1504	23987 (T)
200. <i>Dichodon scaturiginellum</i> (Rech.f.) Assadi	He	IT-ES	2232	23631 (T)
201. <i>Eremogone gypsophiloides</i> (L.) Fenzl	He	IT	2218	24189 (T)
202. <i>Gypsophila laricina</i> Schreb.	Th	IT	2442	23793 (T)
203. <i>Gypsophila vaccaria</i> (L.) Sm.	Th	IT	1980	23988 (T)
204. <i>Holosteum umbellatum</i> subsp. <i>glutinosum</i> (M.Bieb.) Nyman	Th	IT	1518	23239 (T)
205. <i>Minuartia hamata</i> (Hauskn.) Mattf.	Th	IT-M	1621	23307 (T)
206. <i>Minuartia meyeri</i> (Boiss.) Bormm.	Th	IT	1316	23986 (T)
207. <i>Silene arabica</i> Boiss.	He	IT-SS	1132	23226 (T)
208. <i>Silene conica</i> L.	Th	IT-M	1518	23233 (T)
209. <i>Silene conoidea</i> L.	Th	PL	1295–2085	23262 (T)
210. <i>Silene gynodioica</i> Ghaz.	He	IT	1366	23998 (T)
211. <i>Silene noctiflora</i> L.	He	IT-M	2212	23999 (T)
212. <i>Silene montbretiana</i> Boiss.	He	IT	1518	23309 (T)
213. <i>Silene spergulifolia</i> (Willd.) M.Bieb.	He	IT	1293	23311 (T)
214. <i>Stellaria media</i> (L.) Vill.	He	Cos	1293	24189 (T)
215. <i>Velezia rigida</i> L.	Th	IT	1875	23989 (T)
<b>Cistaceae</b>				
216. <i>Helianthemum lippii</i> (L.) Dum.Cours.	Ch	IT	2217	23390 (T)
<b>Cleomaceae</b>				
217. <i>Cleome coluteoides</i> Boiss.	He	IT	1324	23328 (T)
218. <i>Cleome iberica</i> DC.	He	IT	1320	23820 (T)
219. <i>Cleome rupicola</i> Vicary	He	IT	575	23934 (T)
<b>Colchicaceae</b>				
220. <i>Colchicum kotschyi</i> Boiss.	Ge	IT	1992	23499 (T)
221. <i>Colchicum robustum</i> (Bunge) Stef.	Ge	IT-M	2085	23372 (T)
222. <i>Colchicum soboliferum</i> (C.A.Mey.) Stef.	Ge	IT	1807	23130 (T)
223. <i>Colchicum szovitsii</i> Fisch. & C.A.Mey.	Ge	IT-M	1807–2085	23131 (T)
<b>Convolvulaceae</b>				
224. <i>Convolvulus arvensis</i> L.	He	PL	1504	23305 (T)
225. <i>Convolvulus commutatus</i> Boiss.	He	IT	1621	23406 (T)
<b>Crassulaceae</b>				
226. <i>Crassula alata</i> (Viv.) A.Berger	He	IT-M	2473	23900 (T)

227. <i>Rosularia sempervivum</i> (M.Bieb.) A.Berger	He	IT-M	1293	23319 (T)
<b>Cupressaceae</b>				
228. <i>Juniperus excelsa</i> M.Bieb.	Ph	PL	980	23217 (T)
<b>Cyperaceae</b>				
229. <i>Carex melanostachya</i> M.Bieb. ex Willd.	Ge	IT-ES	2028	24157 (T)
230. <i>Carex orbicularis</i> Boott	Ge	PL	2009	24156 (T)
231. <i>Carex oreophila</i> C.A.Mey.	Ge	PL	2152	23386 (T)
232. <i>Carex songorica</i> Kar. & Kir.	Ge	PL	2292	24189 (T)
233. <i>Cyperus rotundus</i> L.	Ge	Cos	504	23610 (T)
234. <i>Eleocharis caduca</i> (Delile) Schult.	Ge	IT	2212–2292	24187 (T)
<b>Elaeagnaceae</b>				
235. <i>Elaeagnus angustifolia</i> L.	Ph	IT	1504	23969 (T)
236. <i>Hippophae rhamnoides</i> L.	Ph	IT	2085	23970 (T)
<b>Ephedraceae</b>				
237. <i>Ephedra ciliata</i> Fisch. & C.A.Mey.	Ch	IT-SS	592	23603 (T)
238. <i>Ephedra foeminea</i> Forssk.	Ch	PL	2100	23645 (T)
239. <i>Ephedra intermedia</i> Schrenk & C.A.Mey.	Ch	IT	980	23208 (T)
240. <i>Ephedra sarcocarpa</i> Aitch. & Hemsl.	Ch	IT	1106	23465 (T)
<b>Equisetaceae</b>				
241. <i>Equisetum arvense</i> L.	Ge	PL	1293	23944 (T)
242. <i>Equisetum telmateia</i> Ehrh.	Ge	PL	1293	23300 (T)
<b>Euphorbiaceae</b>				
243. <i>Euphorbia aucheri</i> Boiss.	He	IT	1106	23449 (T)
244. <i>Euphorbia caeladenia</i> Boiss.	He	IT	2085	23369 (T)
245. <i>Euphorbia helioscopia</i> L.	Th	PL	746–1518	23137 (T)
246. <i>Euphorbia seguieriana</i> Neck.	He	IT-ES	2218	23935 (T)
247. <i>Euphorbia stricta</i> L.	He	IT	1061	23223 (T)
<b>Fabaceae</b>				
248. <i>Alhagi pseudalhagi</i> (M.Bieb.) Desv. ex Wangerin	Ch	IT	637	23633 (T)
249. <i>Alhagi pseudalhagi</i> subsp. <i>persarum</i> (Boiss. & Buhse) Takht.	Ch	IT	1320–1360	23607 (T)
250. <i>Argyrolobium roseum</i> (Cambess.) Jaub. & Spach	Th	IT	637	23629 (T)

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251. <i>Argyrolobium roseum</i> var. <i>subuniflorum</i> Boiss.	He	IT	1423	23460 (T)
252. <i>Astragalus aegobromus</i> Boiss. & Hohen.	He	IT	1082	23280 (T)
253. <i>Astragalus biserrula</i> Bunge	Th	IT	1307	23909 (T)
254. <i>Astragalus brachyodontus</i> Boiss.	He	IT	1315	23281 (T)
255. <i>Astragalus caraganae</i> Fisch. & C.A.Mey.	He	IT	2207	23584 (T)
256. <i>Astragalus curvirostris</i> Boiss.	He	IT	1295–2493	23259 (T)
257. <i>Astragalus eriosphaerus</i> Boiss. & Hausskn.	Ch	IT	1420	23357 (T)
258. <i>Astragalus gypsaceus</i> Beck	Th	IT	1106	23457 (T)
259. <i>Astragalus iranicus</i> Bunge	He	IT	1417-1602	23560 (T)
260. <i>Astragalus lilacinus</i> Boiss.	He	IT	2100	23641 (T)
261. <i>Astragalus microcephalus</i> Willd.	Ch	IT	1293	23327 (T)
262. <i>Astragalus paralurges</i> Bunge	Ch	IT	2122	23688 (T)
263. <i>Astragalus rhodosemius</i> Boiss. & Hausskn.	Ch	IT	2085	23559 (T)
264. <i>Astragalus robustus</i> Bunge	He	IT	1890	23359 (T)
265. <i>Astragalus rubrostriatus</i> Bunge	Ch	IT	2159	23281 (T)
266. <i>Astragalus sciureus</i> Boiss. & Hohen.	Ch	IT	2217	23453 (T)
267. <i>Astragalus semilunatus</i> Podlech	Ch	IT	2129	23780 (T)
268. <i>Astragalus stenolepis</i> Fisch.	Ch	IT	1875	23431 (T)
269. <i>Astragalus tabrizianus</i> Fisch.	He	IT	1420	23350 (T)
270. <i>Astragalus tricholobus</i> DC.	He	IT	2175	23383 (T)
271. <i>Cercis siliquastrum</i> L.	Ph	IT- ES	925	23194 (T)
272. <i>Cicer anatolicum</i> Alef.	He	IT	2090–2207	23557 (T)
273. <i>Hedysarum criniferum</i> Boiss.	He	IT	2100	23640 (T)
274. <i>Lathyrus humilis</i> (Ser.) Fisch. ex Spreng.	He	IT	1138	23283 (T)
275. <i>Lathyrus inconspicus</i> L.	He	IT- ES	1366	23901 (T)
276. <i>Lotus gebelia</i> Vent.	He	IT	535–1106	23578 (T)
277. <i>Medicago orbicularis</i> (L.) Bartal.	Th	IT- ES	1573	23342 (T)
278. <i>Medicago polymorpha</i> L.	Th	PL	1366	23943 (T)
279. <i>Melilotus indicus</i> (L.) All.	Th	IT	1573	23343 (T)
280. <i>Melilotus officinalis</i> (L.) Lam.	He	IT	2240	23807 (T)
281. <i>Onobrychis amoena</i> Popov & Vved.	Ch	IT	555	23973 (T)
282. <i>Onobrychis aucheri</i> Boiss.	Ch	IT	1295–1323	23230 (T)
283. <i>Onobrychis michauxii</i> DC.	Ch	IT	519–637	23460 (T)
284. <i>Ononis spinose</i> L.	Ch	IT	2085	23974 (T)
285. <i>Prosopis farcta</i> (Banks & Sol.) J.F.Macbr.	Ph	IT	504–674	23608 (T)

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286. <i>Scorpiurus muricatus</i> L.	Th	IT	530–1573	23188 (T)
287. <i>Sophora alopecuroides</i> subsp. <i>tomentosa</i> (Boiss.) Bornm.	Ch	PL	1504	23951 (T)
288. <i>Trifolium pratense</i> L.	He	PL	2218	23945 (T)
289. <i>Trifolium tomentosum</i> L.	He	PL	2212	23941 (T)
290. <i>Trigonella coeruleascens</i> (M.Bieb.) Halácsy	Th	IT	1621	23400 (T)
291. <i>Trigonella spruneriana</i> Boiss.	Th	PL	750	23156 (T)
<b>Geraniaceae</b>				
292. <i>Erodium cicutarium</i> (L.) L'Hér.	He	PL	530	23190 (T)
293. <i>Erodium oxyrhinchum</i> M.Bieb.	Th-He	IT	535	23588 (T)
294. <i>Geranium divaricatum</i> Ehrh.	Th	PL	908	23486 (T)
295. <i>Geranium kotschy</i> Boiss.	Ge	IT	1082	23278 (T)
296. <i>Geranium lucidum</i> L.	Th	PL	1293	23318 (T)
297. <i>Geranium tuberosum</i> L.	Ge	PL	1417	23248 (T)
<b>Hypericaceae</b>				
298. <i>Hypericum linarioides</i> Bosse	He	IT-ES	1875	23423 (T)
299. <i>Hypericum perforatum</i> L.	He	PL	2240	23806 (T)
300. <i>Hypericum scabrum</i> L.	He	IT	1875–2442	23796 (T)
<b>Iridaceae</b>				
301. <i>Crocus haussknechtii</i> (Boiss. & Reut. ex Maw) Boiss.	Ge	IT	2085	23255 (T)
302. <i>Gladiolus atroviolaceus</i> Boiss.	Ge	IT-M	908–1366	23479 (T)
303. <i>Iris meda</i> Stapf	Ge	IT	1316	24159 (T)
<b>Ixiliaceae</b>				
304. <i>Ixiolirion tataricum</i> (Pall.) Schult. & Schult.f.	Ge	IT	1621–2207	23402 (T)
<b>Juglandaceae</b>				
305. <i>Juglans regia</i> L.	Ph	PL	1285	23198 (T)
<b>Juncaceae</b>				
306. <i>Juncus inflexus</i> L.	He	PL	2212	24188 (T)
<b>Lamiaceae</b>				
307. <i>Clinopodium graveolens</i> (M.Bieb.) Kuntze	Th	PL	2085–2292	23547 (T)
308. <i>Dracocephalum ibericum</i> M.Bieb.	Th	IT	2185–2487	23552 (T)
309. <i>Dracocephalum peltatum</i> L.	Th	IT	2493	23638 (T)
310. <i>Lagochilus aucheri</i> Boiss.	He	IT	1322	23164 (T)

311. <i>Lamium album</i> L.	He	IT-ES	908–2493	23483 (T)
312. <i>Lamium amplexicaule</i> L.	Th	PL	1138–1992	23290 (T)
313. <i>Lamium amplexicaule</i> var. <i>allepicum</i> (Boiss. & Hausskn.) Bormm.	Th	IT	2009	23503 (T)
314. <i>Marrubium astracanicum</i> Jacq.	He	IT-M	1895	23556 (T)
315. <i>Mentha longifolia</i> var. <i>asiatica</i> (Boriss.) Rech.f.	He	PL	1504	23977 (T)
316. <i>Nepeta betonicifolia</i> subsp. <i>strictifolia</i> (Pojark.) Menitsky	He	IT	2090–2493	23661 (T)
317. <i>Nepeta heliotropifolia</i> Lam.	He	IT	1980	23567 (T)
318. <i>Nepeta meyeri</i> Benth.	He	IT	1417	23246 (T)
319. <i>Phlomis lanceolate</i> Boiss. & Hohen.	He	IT	2085	23976 (T)
320. <i>Phlomis olivieri</i> Benth.	He	PL	2175	23675 (T)
321. <i>Phlomoidea laciniata</i> (L.) Kamelin & Makhm.	He	IT	1875	23421 (T)
322. <i>Phlomoidea laevigata</i> (Bunge) Kamelin & Makhm.	He	IT	2487	24175 (T)
323. <i>Salvia aristata</i> Aucher ex Benth.	He	IT	2100	23650 (T)
324. <i>Salvia ceratophylla</i> L.	He	IT	1621	23404 (T)
325. <i>Salvia hydrangea</i> DC. ex Benth.	He	IT	724	23471 (T)
326. <i>Salvia nemorosa</i> L.	He	IT-M	1504	23975 (T)
327. <i>Salvia reuteriana</i> Boiss.	He	IT-SS	2175–2493	23554 (T)
328. <i>Salvia sclarea</i> L.	He	IT-M	592	23595 (T)
329. <i>Salvia viridis</i> L.	Th	PL	566	23193 (T)
330. <i>Stachys annua</i> (L.) L.	He	IT-M	1273	23296 (T)
331. <i>Stachys fruticulosa</i> M.Bieb.	He	IT	1295	23258 (T)
332. <i>Stachys lavandulifolia</i> Vahl	He	IT	1875–2090	23376 (T)
333. <i>Stachys setifera</i> C.A.Mey.	He	IT-M	2240	23805 (T)
334. <i>Teucrium polium</i> L.	Ch	IT-M	1106	23452 (T)
335. <i>Thymus daenensis</i> subsp. <i>lancifolius</i> (Čelak.) Jalas	He	IT	2218	24173 (T)
336. <i>Ziziphora clinopodioides</i> Lam.	He	IT-ES	2442	23795 (T)
337. <i>Ziziphora persica</i> Bunge	Th	IT	1875	23458 (T)
338. <i>Ziziphora tenuir</i> L.	Th	IT	2085	23949 (T)
<b>Liliaceae</b>				
339. <i>Fritillaria gibbosa</i> Boiss.	Ge	IT	1309	24163 (T)
340. <i>Gagea chomutovae</i> (Pascher) Pascher	Ge	IT	2009	24161 (T)
341. <i>Gagea dschungarica</i> Regel	Ge	IT	1854	24160 (T)
342. <i>Gagea kunawurensis</i> (Royle) Greuter	Ge	IT	2085	23349 (T)
343. <i>Gagea reticulata</i> (Pall.) Schult. & Schult.f.	Ge	IT	1356–1417	23163 (T)

344. <i>Tulipa biflora</i> Pall.	Ge	IT	1310	23158 (T)
345. <i>Tulipa hoogiana</i> B.Fedtsch.	Ge	IT	1320	23162 (T)
346. <i>Tulipa undulatifolia</i> var. <i>micheliana</i> (Hoog) Wilford	Ge	IT	777	23222 (T)
<b>Linaceae</b>				
347. <i>Linum catharticum</i> L.	Th	IT	1135	23209 (T)
348. <i>Linum nodiflorum</i> L.	Th	PL	1287	23533 (T)
349. <i>Linum usitatissimum</i> L.	He	IT	1621	23398 (T)
<b>Lythraceae</b>				
350. <i>Punica granatum</i> L.	Ph	PL	479	23176 (T)
<b>Malvaceae</b>				
351. <i>Alcea transcaucasica</i> (Iljin) Iljin	Ch	IT	2085	23174 (T)
352. <i>Alcea wilhelmiae</i> var. <i>lineariloba</i> (I.Riedl) Pakravan	Ch	IT	592–918	23592 (T)
353. <i>Malva aegyptia</i> L.	Th	IT	530	23180 (T)
354. <i>Malva neglecta</i> Wallr.	He	IT - SS	2175	23639 (T)
<b>Moraceae</b>				
355. <i>Ficus carica</i> L.	Ph	IT-M	592	23968 (T)
<b>Oleaceae</b>				
356. <i>Chrysojasminum fruticans</i> (L.) Banfi	Ph	IT-M	1061–1324	23200 (T)
<b>Onagraceae</b>				
357. <i>Epilobium roseum</i> subsp. <i>subsessile</i> (Boiss.) P.H.Raven	He	IT- ES	2218	23967 (T)
<b>Orchidaceae</b>				
358. <i>Orchis mascula</i> (L.) L.	Ge	PL	2218–2232	23630 (T)
359. <i>Orchis simia</i> Lam.	Ge	IT- ES	980	23207 (T)
<b>Orobanchaceae</b>				
360. <i>Orobanche caryophyllacea</i> Sm.	Ge	IT- ES	519	23228 (T)
361. <i>Parentucellia latifolia</i> (L.) Caruel	Th	IT-M	980	23219 (T)
<b>Papaveraceae</b>				
362. <i>Corydalis verticillaris</i> subsp. <i>boissieri</i> (Prain) Wendelbo	Ge	IT	2473	23996 (T)
363. <i>Fumaria asepala</i> Boiss.	Th	PL	1992–2493	23506 (T)
364. <i>Fumaria vaillantii</i> Loisel.	Th	PL	1138–1992	23493 (T)
365. <i>Glaucium contortuplicatum</i> Boiss.	He	IT- ES	535–1106	23587 (T)



366. <i>Glaucium corniculatum</i> (L.) Curtis	He	IT	746–1295	23149 (T)
367. <i>Glaucium elegans</i> Fisch. & C.A.Mey.	Th	IT	1316	24166 (T)
368. <i>Glaucium flavum</i> Crantz	He	IT-M	1366	24169 (T)
369. <i>Glaucium grandiflorum</i> Boiss. & A.Huet	He	IT	476	24164 (T)
370. <i>Glaucium oxylobum</i> Boiss. & Buhse	He	IT	1287–1316	23171 (T)
371. <i>Papaver commutatum</i> Fisch. C.A.Mey. & Trautv.	He	IT-M		24067 (T)
372. <i>Papaver decaisnei</i> Hochst. & Steud. ex Elkan	Th	IT	1316–1621	23405 (T)
373. <i>Papaver dubium</i> L.	Th	PL	925	23197 (T)
374. <i>Papaver glaucum</i> Boiss. & Hausskn.	He	IT	535	23583 (T)
375. <i>Papaver macrostomum</i> Boiss. & A.Huet	Th	IT	504	24069 (T)
376. <i>Papaver orientale</i> L.	He	IT	1366	24062 (T)
377. <i>Papaver tenuifolium</i> Boiss. & Hohen.	He	IT-M	535	23580 (T)
378. <i>Roemeria hybrida</i> (L.) DC.	Th	PL	479–1282	23167 (T)
379. <i>Roemeria pavonina</i> (Schrenk) Banfi, Bartolucci, J.-M.Tison & Galasso	Th	IT	479	23173 (T)
380. <i>Roemeria sicula</i> (Guss.) Galasso, Banfi, L.Sáez & Bartolucci	Th	IT-M	424–467	24070 (T)
<b>Plantaginaceae</b>				
381. <i>Linaria chalepensis</i> (L.) Mill. var. <i>chalepensis</i>	Th	IT-SS	1013	24150 (T)
382. <i>Plantago atrata</i> Hoppe	He	PL	2152	24020 (T)
383. <i>Plantago coronopus</i> L.	He	IT-SS	1573	23338 (T)
384. <i>Plantago indica</i> L.	Th	PL	423	23995 (T)
385. <i>Plantago lanceolata</i> L.	He	PL	918–1573	23341 (T)
386. <i>Plantago major</i> L.	He	IT-ES	1504	23263 (T)
387. <i>Plantago ovata</i> Forssk.	Th	PL	423	23271 (T)
388. <i>Veronica anagallis-aquatica</i> L.	Ge	IT	2090	23667 (T)
389. <i>Veronica biloba</i> Schreb. ex L.	Th	IT	2290–2473	23530 (T)
390. <i>Veronica campylopoda</i> Boiss.	Th	IT	2020	23491 (T)
391. <i>Veronica hederifolia</i> L.	Th	PL	1293	23312 (T)
392. <i>Veronica multifida</i> L.	He	IT	2100	23651 (T)
393. <i>Veronica orientalis</i> Mill.	He	IT	1061	23224 (T)
<b>Platanaceae</b>				
394. <i>Platanus orientalis</i> L.	Ph	IT-M	1293	23302 (T)
<b>Plumbaginaceae</b>				
395. <i>Acantholimon asphodelinum</i> Mobayen	Ch	IT	1314	23410 (T)

396. <i>Acantholimon rudbaricum</i> (Bornm.) Bornm.	Ch	IT	707	23322 (T)
397. <i>Acantholimon scorpius</i> (Jaub. & Spach) Boiss.	Ch	IT	1300	23589 (T)
398. <i>Acantholimon wendelboi</i> Rech.f. & Schiman-Czeika	Ch	IT	2442	23792 (T)
<b>Poaceae</b>				
399. <i>Aegilops neglecta</i> Req. ex Bertol.	Th	IT	1322	24154 (T)
400. <i>Aegilops tauschii</i> Coss.	Th	IT	724	23474 (T)
401. <i>Aegilops triuncialis</i> L.	Th	IT	2020	24136 (T)
402. <i>Alopecurus arundinaceus</i> Poir.	Ge	PL	2490	24185 (T)
403. <i>Alopecurus pratensis</i> L.	He	IT	2028	24151 (T)
404. <i>Avena barbata</i> Pott ex Link	Th	IT	1082	23277 (T)
405. <i>Bromus catharticus</i> Vahl	Th	IT- ES	637–912	23467 (T)
406. <i>Bromus danthoniae</i> Trin.	Th	PL	1298	24152 (T)
407. <i>Bromus pumilio</i> (Trin.) P.M.Sm.	Th	IT-M	1322	24153 (T)
408. <i>Bromus sclerophyllus</i> Boiss.	He	IT- ES	2292	24181 (T)
409. <i>Bromus sterilis</i> L.	Th	PL	2487	24139 (T)
410. <i>Bromus tectorum</i> L.	Th	PL	1295–2085	23254 (T)
411. <i>Bromus tomentellus</i> Boiss.	He	IT	530	23331 (T)
412. <i>Cynodon dactylon</i> (L.) Pers.	He	PL	1504	23179 (T)
413. <i>Dactylis glomerata</i> L.	He	PL	1297	24179 (T)
414. <i>Echinaria capitata</i> (L.) Desf.	Th	IT-M	1366	24130 (T)
415. <i>Echinochloa crus-gali</i> (L.) P.Beauv.	Th	PL	1504	23195 (T)
416. <i>Eremopyrum bonaepartis</i> (Spreng.) Nevski	Th	IT	1198	24131 (T)
417. <i>Eremopyrum distans</i> (K.Koch) Nevski	Th	IT	1316	24132 (T)
418. <i>Festuca hirtiglumis</i> (Boiss. & Hausskn.) Sennikov	Th	IT	2487	24183 (T)
419. <i>Festuca orientalis</i> (Boiss.) B.Fedtsch.	He	IT	1512	24133 (T)
420. <i>Heterantherium piliferum</i> (Sol.) Hochst. ex Jaub. & Spach	Th	IT	2175–2292	23447 (T)
421. <i>Hordeum brevisubulatum</i> (Trin.) Link	He	IT-M	2490	24186 (T)
422. <i>Hordeum bulbosum</i> L.	Ge	IT- ES	2212	24180 (T)
423. <i>Hordeum marinum</i> Huds.	Th	IT	1324	23330 (T)
424. <i>Hordeum murinum</i> subsp. <i>glaucum</i> (Steud.) Tzvelev	He	IT- ES	1504	23497 (T)
425. <i>Lolium perenne</i> L.	He	IT	2212	24182 (T)
426. <i>Lolium temulentum</i> L.	He	PL	1316	24138 (T)
427. <i>Phleum montanum</i> K.Koch	He	PL	1875	23427 (T)
428. <i>Phragmites australis</i> (Cav.) Trin. ex Steud.	He	Cos	2085	23377 (T)

429. <i>Poa bulbosa</i> L.	He	PL	1322–1518	23234 (T)
430. <i>Poa pratensis</i> L.	He	PL	2129	23379 (T)
431. <i>Rhizocephalus orientalis</i> Boiss.	Th	IT	1282	24134 (T)
432. <i>Rostraria cristata</i> (L.) Tzvelev	He	PL	2085	23201 (T)
433. <i>Rostraria pumila</i> (Lam.) Tzvelev	He	IT	724	23475 (T)
434. <i>Setaria viridis</i> (L.) P.Beauv.	Th	PL	1504	23204 (T)
435. <i>Stipa arabica</i> Trin. & Rupr.	He	IT	724	23472 (T)
436. <i>Taeniatherum caput-medusae</i> (L.) Nevski	Th	IT	2028–2290	24193 (T)
<b>Polygonaceae</b>				
437. <i>Atraphaxis aucheri</i> Jaub. & Spach	Ch	IT	1320	23729 (T)
438. <i>Atraphaxis spinosa</i> L.	Ch	IT	1320	23824 (T)
439. <i>Persicaria lapathifolia</i> (L.) Delarbre	He	IT	2240	23801 (T)
440. <i>Polygonum cognatum</i> Meisn.	He	PL	2085–2175	23374 (T)
441. <i>Polygonum hyrcanicum</i> Rech.f.	He	IT	555	23572 (T)
442. <i>Pteropyrum aucheri</i> Jaub. & Spach	Ch	IT	1320	23902 (T)
443. <i>Rheum ribes</i> L.	Ge	IT	1366–2009	23939 (T)
444. <i>Rumex chalepensis</i> Mill.	Th	IT	2085	23272 (T)
445. <i>Rumex scutatus</i> L.	He	PL	2090	23535 (T)
<b>Polypodiaceae</b>				
446. <i>Polypodium interjectum</i> Shivas	Ge	PL	1293	23965 (T)
<b>Portulacaceae</b>				
447. <i>Portulaca oleracea</i> L.	He	IT-ES	2171	23964 (T)
<b>Primulaceae</b>				
448. <i>Androsace maxima</i> L.	Th	IT-M	746	23143 (T)
449. <i>Lysimachia arvensis</i> (L.) U.Manns & Anderb.	Th	Cos	746	23145 (T)
<b>Pteridaceae</b>				
450. <i>Adiantum capillus-veneris</i> L.	Ge	Cos	1293	23963 (T)
<b>Ranunculaceae</b>				
451. <i>Adonis flammea</i> Jacq.	Th	PL	530	23181 (T)
452. <i>Ceratocephalus falcatus</i> (L.) Pers.	Th	PL	1287–2085	23347 (T)
453. <i>Delphinium teheranicum</i> Boiss.	Th	IT	504	23609 (T)
454. <i>Delphinium tuberosum</i> Aucher ex Boiss.	Ge	IT	1307	23907 (T)
455. <i>Ranunculus arvensis</i> L.	Th	PL	1138–2290	23400 (T)

456. <i>Ranunculus cicutarius</i> Schldtl.	Ge	IT	2100	23642 (T)
457. <i>Ranunculus dissectus</i> M.Bieb.	He	IT-ES	980–2085	23361 (T)
458. <i>Ranunculus elbrusensis</i> Boiss.	Ge	IT-M	2217–2473	23515 (T)
459. <i>Ranunculus kochii</i> Ledeb.	Ge	IT	2473	23905 (T)
460. <i>Ranunculus oxyspermus</i> Willd.	Ge	IT	1980	23569 (T)
461. <i>Ranunculus sericeus</i> Bank & Sol.	He	IT	1366	23908 (T)
462. <i>Thalictrum isopyroides</i> C.A.Mey.	Ge	IT	2009	23906 (T)
<b>Resedaceae</b>				
463. <i>Reseda lutea</i> L.	He	PL	707–2100	23154 (T)
<b>Rhamnaceae</b>				
464. <i>Paliurus spina-christi</i> Mill.	Ph	PL	479–1106	23172 (T)
<b>Rosaceae</b>				
465. <i>Cotoneaster luristanicus</i> G.Klotz	Ph	IT	1082	23273 (T)
466. <i>Cotoneaster nummularioides</i> Pojark.	Ph	IT	592	23978 (T)
467. <i>Crataegus meyeri</i> Pojark.	Ph	PL	980–2240	23798 (T)
468. <i>Crataegus pontica</i> K.Koch	Ph	PL	1082	23276 (T)
469. <i>Crataegus turkestanica</i> Pojark.	Ph	IT	1082	23279 (T)
470. <i>Geum urbanum</i> L.	He	PL	908	23482 (T)
471. <i>Potentilla recta</i> L.	He	PL	592	23594 (T)
472. <i>Prunus argentea</i> (Lam.) Rehder	Ph	IT	450	23648 (T)
473. <i>Prunus lycioides</i> (Spach) C.K.Schneid.	Ph	IT	479–1082	23168 (T)
474. <i>Prunus mahaleb</i> L.	Ph	IT	980	23220 (T)
475. <i>Prunus microcarpa</i> C.A.Mey.	Ph	IT	980–1293	23215 (T)
476. <i>Rosa beggeriana</i> Schrenk ex Fisch. & C.A.Mey.	Ph	IT-ES	1106	23466 (T)
477. <i>Rosa boissieri</i> Crép.	Ch	IT	2240	23799 (T)
478. <i>Rosa canina</i> L.	Ph	PL	2100	23655 (T)
479. <i>Rosa persica</i> Michaut ex Juss.	Ch	IT	1315	23371 (T)
480. <i>Rubus creticus</i> Tourn. ex L.	Ph	IT-M	504	23611 (T)
481. <i>Sanguisorba minor</i> Scop.	He	PL	912–2493	23491 (T)
482. <i>Sibbaldianthe bifurca</i> (L.) Kurtto & T.Erikss.	Th	IT-ES	2085–2207	23352 (T)
<b>Rubiaceae</b>				
483. <i>Asperula arvensis</i> L.	Th	PL	1138	23287 (T)
484. <i>Asperula setosa</i> Jaub. & Spach	Th	IT	2493	23539 (T)

485. <i>Callipeltis cucullaria</i> (L.) DC.	Th	IT-M	1621	23408 (T)
486. <i>Cruciata laevipes</i> Opiz	He	IT-ES	2148	23937 (T)
487. <i>Cruciata taurica</i> (Pall. ex Willd.) Ehrend.	He	IT-M	2207	23558 (T)
488. <i>Galium aparine</i> L.	Th	PL	1913	23913 (T)
489. <i>Galium diploprion</i> Boiss. & Hohen.	Th	IT	1573	23337 (T)
490. <i>Galium verum</i> L.	He	PL	2240	23197 (T)
<b>Rutaceae</b>				
491. <i>Haplophyllum acutifolium</i> (DC.) G.Don	He	IT	2207	23565 (T)
<b>Salicaceae</b>				
492. <i>Populus euphratica</i> Olivier	Ph	IT	535	23584 (T)
493. <i>Salix acmophylla</i> Boiss.	Ph	IT	2493	23538 (T)
<b>Santalaceae</b>				
494. <i>Thesium procumbens</i> C.A.Mey.	He	IT	2473	23958 (T)
<b>Sapindaceae</b>				
495. <i>Acer cappadocicum</i> Gled.	Ph	IT-ES	1293	23310 (T)
496. <i>Acer monspessulanum</i> L.	Ph	IT	980	23205 (T)
<b>Scrophulariaceae</b>				
497. <i>Scrophularia azerbaijanica</i> Grau	He	IT	1875	23432 (T)
498. <i>Scrophularia catariifolia</i> Boiss. & Heldr.	He	IT	2085	23368 (T)
499. <i>Scrophularia rechingeri</i> Grau	He	IT	2080	23363 (T)
500. <i>Scrophularia striata</i> Boiss.	He	IT-SS	2090	23662 (T)
501. <i>Verbascum cheirantifolium</i> Boiss.	He	PL	2138	23789 (T)
502. <i>Verbascum orientale</i> (L.) All.	He	IT-ES	566–925	23191 (T)
503. <i>Verbascum songaricum</i> Schrenk ex Fisch. & C.A.Mey.	He	PL	2240	23800 (T)
<b>Solanaceae</b>				
504. <i>Hyoscyamus niger</i> L.	He	IT-M	1293–1573	23961 (T)
505. <i>Hyoscyamus pusillus</i> L.	Th	IT	1350	23096 (T)
506. <i>Hyoscyamus reticulatus</i> L.	He	IT-M	1504	23960 (T)
507. <i>Lycium depressum</i> Stocks	Ph	IT	479	23175 (T)
508. <i>Lycium ruthenicum</i> Murray	Ph	IT	1320	23831 (T)
509. <i>Solanum nigrum</i> L.	Th	Cos	1504	23961 (T)

<b>Tamaricaceae</b>				
510.	<i>Tamarix ramosissima</i> Ledeb.	Ph	PL	535–1360 23959 (T)
<b>Thymelaeaceae</b>				
511.	<i>Diarthron lessertii</i> (Wikstr.) Kit Tan	Ch	IT	637–1360 23622 (T)
<b>Urticaceae</b>				
512.	<i>Urtica dioica</i> L.	He	Cos	2090 23659 (T)
<b>Violaceae</b>				
513.	<i>Viola arvensis</i> Murray	Th	IT-M	530–2085 23189 (T)
514.	<i>Viola modesta</i> Fenzl	Th	IT	908–1138 23214 (T)
515.	<i>Viola occulta</i> Lehm.	Th	IT	908–2085 23354 (T)
<b>Vitaceae</b>				
516.	<i>Vitis vinifera</i> L.	Ph	IT-ES	592 23957 (T)
<b>Xanthorrhoeaceae</b>				
517.	<i>Eremurus inderiensis</i> (M.Bieb.) Regel	Ge	IT	1322 24172 (T)
518.	<i>Eremurus kopet-daghensis</i> Karrer	Ge	IT	1295 23251 (T)
519.	<i>Eremurus spectabilis</i> M.Bieb.	Ge	IT	1295 23647 (T)
<b>Zygophyllaceae</b>				
520.	<i>Peganum harmala</i> L.	He	PL	674–1360 23612 (T)
521.	<i>Tribulus terrestris</i> L.	Th	PL	1504 23948 (T)
522.	<i>Zygophyllum atriplicoides</i> subsp. <i>eurypterum</i> (Boiss. & Buhse) Popov	Ph	IT	746–1298 23151 (T)
523.	<i>Zygophyllum fabago</i> L.	He	IT	637 23616 (T)

**Table 2.** List of angiosperms orders and families in SPA.

Monocots			Asparagales	Orchidaceae, Ixiliaceae, Iridaceae, Amaryllidaceae, Asparagaceae, Xanthorrhoeaceae		
				Liliales	Colchicaceae, Liliaceae	
	Commelinids		Poales	Juncaceae, Cyperaceae, Poaceae		
Eudicots			Ranunculales	Papaveraceae, Berberidaceae, Ranunculaceae		
			Proteales	Platanaceae		
			Saxifragales	Crassulaceae		
	Core Eudicots	Superrosids	Rosids	Fabids	Fabales	Fabaceae
				Rosales	Rosaceae, Elaeagnaceae, Rhamnaceae, Moraceae, Urticaceae	
				Fagales	Juglandaceae	
				Malpighiales	Hypericaceae, Violaceae, Salicaceae, Euphorbiaceae, Linaceae	
				Zygophyllales	Zygophyllaceae	
			Malvids	Geraniales	Geraniaceae	
				Myrtales	Lythraceae, Onagraceae	

		Superasterids		Malvales	Malvaceae, Thymelaeaceae, cistaceae		
				Brassicales	Resedaceae, Capparaceae, Cleomaceae, Brassicaceae		
				Sapindales	Biebersteiniaceae, Anacardiaceae, Sapindaceae, Rutaceae		
				Vitales	Vitaceae		
				Santalales	Santalaceae		
				Caryophyllales	Tamaricaceae, Plumbaginaceae, Polygonaceae, Caryophyllaceae, Amaranthaceae, Portulacaceae		
			Asterids	Ericales	Ericales	Primulaceae	
					Campanulids	Asterales	Asteraceae
						Apiales	Apiaceae
				Dipsacales		Caprifoliaceae	
				Lamiids	Boraginales	Boraginaceae	
					Gentianales	Rubiaceae, Apocynaceae	
					Lamiales	Oleaceae, Plantaginaceae, Scrophulariaceae, Lamiaceae, Orobanchaceae	
Solanales	Convulvolaceae, Solanaceae						





**Fig. 2.** Vascular plants recorded of Sorkhabad Protected Area. **A.** *Ephedra ciliata*, **B.** *Colchicum soboliferum*, **C.** *Colchicum szovitsii*, **D.** *Gagea reticulata*, **E.** *Allium materculae*, **F.** *Allium akaka*, **G.** *Orchis simia*, **H.** *Eremurus kopet-daghensis*, **I.** *Ornithogalum orthophyllum*, **J.** *Eremopyrum distans*, **K.** *Papaver tenuifolium*, **L.** *Roemeria sicula*.







**Fig. 3.** Vascular plants recorded of Sorkhabad Protected Area. **A.** *Delphinium tuberosum*, **B.** *Glaucium oxylobum*, **C.** *Leontice armeniaca*, **D.** *Ranunculus kochii*, **E.** *Ranunculus oxyspermus*, **F.** *Crassula alata*, **G.** *Rosularia sempervivum*, **H.** *Medicago orbicularis*, **I.** *Astragalus gypsaceus*, **J.** *Hypericum perforatum*, **K.** *Paliurus spina-christi*, **L.** *Euphorbia helioscopia*.





**Fig. 4.** Vascular plants recorded of Sorkhabad Protected Area. **A.** *Euphorbia stricta*, **B.** *Linum nodiflorum*, **C.** *Alcea wilhelmiae*, **D.** *Capparis spinosa*, **E.** *Cleome coluteoides*, **F.** *Cleome iberica*, **G.** *Galium diploprium*, **H.** *Cynanchum acutum*, **I.** *Caccinia macranthera*, **J.** *Echium italicum*, **K.** *Paracaryum strictum*, **L.** *Rochelia persica*.





**Fig. 5.** Vascular plants recorded of Sorkhabad Protected Area. **A.** *Cleome rupicola*, **B.** *Biebersteinia multifida*, **C.** *Aethionema grandiflorum*, **D.** *Alliaria petiolata*, **E.** *Hirschfeldia incana*, **F.** *Nasturtium officinale*, **G.** *Acantholimon asphodelinum*, **H.** *Atraphaxis aucheri*, **I.** *Atraphaxis spinosa*, **J.** *Persicaria lapathifolia*, **K.** *Polygonum cognatum*, **L.** *Polygonum hyrcanicum*.



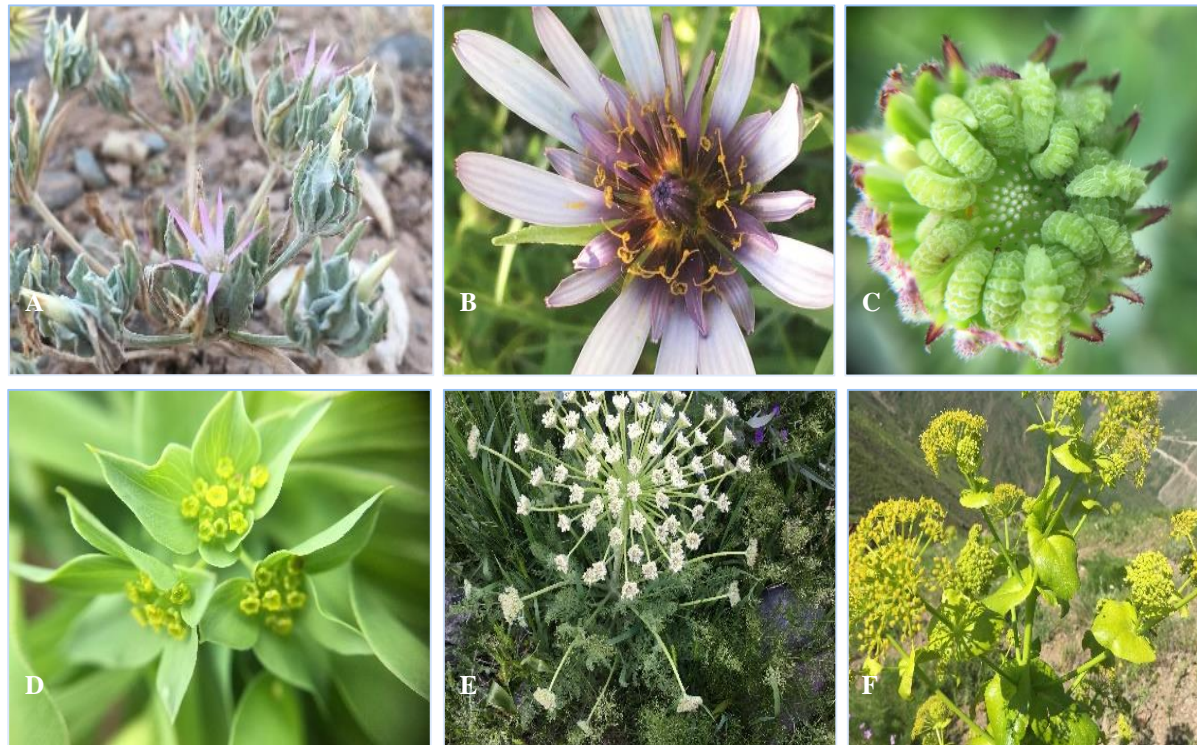


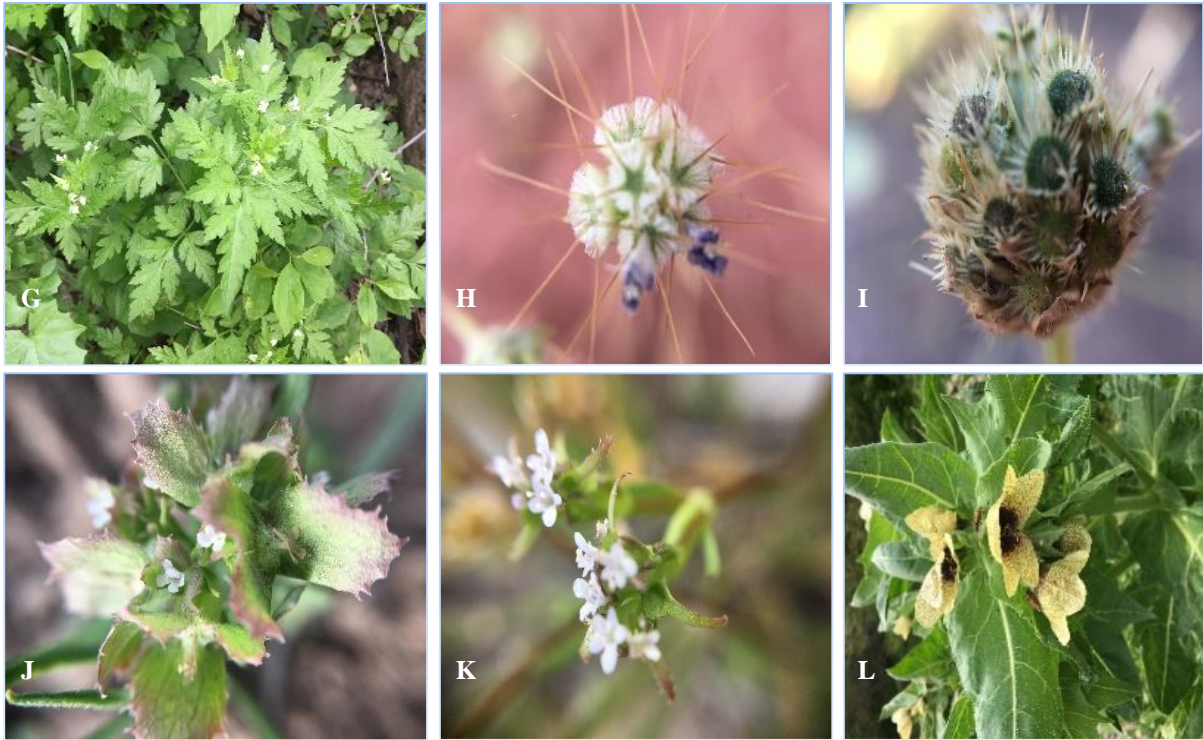
**Fig. 6.** Vascular plants recorded of Sorkhabad Protected Area. **A.** *Cerastium inflatum*, **B.** *Stellaria media*, **C.** *Minuartia hamata*, **D.** *Epilobium roseum*, **E.** *Halimocnemis malacophylla*, **F.** *Echinops acantholepis*, **G.** *Amberboa sosnovskyi*, **H.** *Centaurea bruguierana*, **I.** *Centaurea virgata*, **J.** *Centaurea benedicta*, **K.** *Filago desertorum*, **L.** *Gundelia tournefortii*.





**Fig. 7.** Vascular plants recorded of Sorkhabad Protected Area. **A.** *Inula aucheriana*, **B.** *Helichrysum arenarium*, **C.** *Inula helenium*, **D.** *Koelipinia linearis*, **E.** *Jurinea carduiiformis*, **F.** *Oligochaeta tomentosa*, **G.** *Sclerorhachis platyrachis*, **H.** *Pseudopodospermum papposum*, **I.** *Psephellus gilanicus*, **J.** *Senecio glaucus*, **K.** *Xanthium spinosum*, **L.** *Tussilago farfara*.



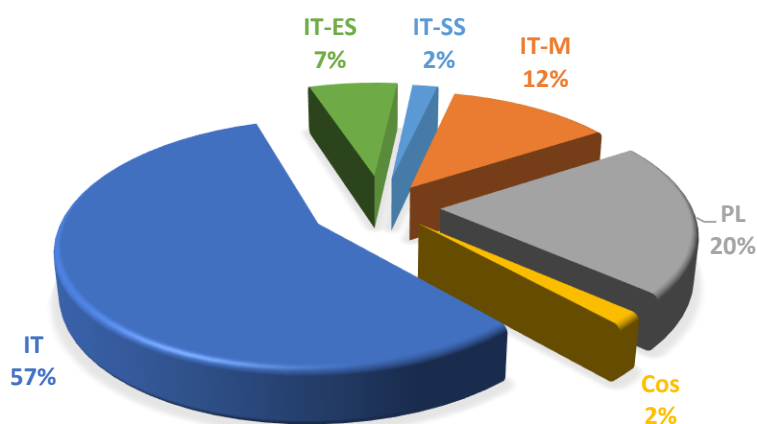


**Fig. 8.** Vascular plants recorded of Sorkhabad Protected Area. **A.** *Siebera nana*, **B.** *Tragopogon porphyrocephalus*, **C.** *Calendula arvensis*, **D.** *Bupleurum lancifolium*, **E.** *Laser carduchorum*, **F.** *Smyrniium cordifolium*, **G.** *Anthriscus cerefolium*, **H.** *Lomelosia calocephala*, **I.** *Cephalaria microcephala*, **J.** *Valeriana orientalis*, **K.** *Valeriana oxyrhyncha*, **L.** *Hyoscyamus niger*.





**Fig. 9.** Vascular plants recorded of Sorkhabad Protected Area. **A.** *Lycium depressum*, **B.** *Lycium ruthenicum*, **C.** *Veronica biloba*, **D.** *Veronica hederifolia*, **E.** *Salvia ceratophylla*, **F.** *Clinopodium graveolens*, **G.** *Phlomis laciniata*, **H.** *Lamium album*, **I.** *Lamium amplexicaule* var. *allepicum*, **J.** *Salvia viridis*, **K.** *Asperula setosa*, **L.** *Callipeltis cucullaria*.



**Fig. 10.** Proportional percentage of phytogeographical types of the SPA recorded species. IT (Irano-Turanian), ES (Euro-Siberian), M (Mediterranean), SS (Shaharo-Sindian), PI (Pluriregional), Cos (Cosmopolitan).

## DISCUSSION

Among the orders and families presented in APG IV, 39 orders and 132 families have members in Iran (APG 2016). Sixty-five angiosperm families (49% of angiosperm families in Iran) and 26 angiosperm orders (67% of angiosperm orders in Iran) had representatives in SPA, reflecting the high angiosperm diversity in this area. The largest families of Iran were Fabaceae, Asteraceae, and Poaceae in terms of the number of species and Asteraceae, Poaceae, Apiaceae, and Fabaceae in terms of the number of genera (Rechinger *et al.* 1963-2015; Assadi *et al.* 1988-2024; Ghahremaninejad & Nejad Falatoury 2016; Bidarlord & Ghahremaninejad 2022). In SPA, eight families, including Asteraceae (13%) Fabaceae (8%), Poaceae (7%), Brassicaceae (about 7%), Lamiaceae (6%), Boraginaceae and Apiaceae (each including 5%), and Caryophyllaceae (4%) were the largest families in terms of the number of species (Fig. 11). These families account for 55% of the plant species in this area. Each of the other

families had less than 20 species. About one-third of all the families were represented by only one species. Among the monotypic families of the area, Portulacaceae, Platanaceae, Ixiliriaceae, and Biebersteiniaceae also have only one species in Iran. In SPA, Asteraceae was the largest family regarding species and genera. Members of this family can spread easily, some of which have spines for protection against potential grazers; in addition, the family has a wide ecological tolerance (Archibold 1995). Another major group in the study area was Grasses. According to available information on the natural distribution of grasses, 50% of all species experience cold and freezing, suggesting that adaptations to these conditions are common and widespread in the Poaceae (Schubert *et al.* 2020). The members of this family were distributed in most parts of the study area and covered slopes of the heights. Also, perennial grasses such as *Alopecurus pratensis*, *Bromus tomentellus*, *Hordeum bulbosum*, *Lolium perenne*, and *Poa bulbosa* were found in the high and cold regions of the area. Due to *Astragalus* being included in the family Fabaceae, this family has attained first place in terms of species number in Iran (Ghahremaninejad *et al.* 2016; Ghahremaninejad & Joharchi 2020). Fabaceae is the second and fifth largest family in the SPA, regarding the number of species and genera, respectively. Consisting of 19 species, *Astragalus* was the largest genus in the SPA. Moreover, *Astragalus biserrula*, and *A. lilacinus* were new records from Zanjan Province. The other richest genera are *Bromus*, *Papaver*, *Salvia*, and *Silene* (each with 7 species) followed by *Allium*, *Centaurea*, and *Glaucium* (each with 6 species). The taxa of *Astragalus*, *Allium*, *Centaurea*, and *Silene* are typical members of the Irano-Turanian region. Iran is regarded as one of the important regions for *Salvia* diversity (Jamzad & Moein 2017), and in the SPA, the *Salvia* species are found in its different regions. *Papaver* comprises about 100 species, found primarily in temperate regions of the northern hemisphere (Goldblatt 1974), and in this area, most of its species were distributed in the eastern half. The dominance of hemicryptophytes and therophytes was in accordance with climatic conditions (Raunkiaer 1934) and indicating the cold mountain climate in most parts of the SPA. This result is similar to other studies conducted in mountain ecosystems such as Noroozi *et al.* 2010 and Aghajani *et al.* 2023. Except for the elevational zone of 400 to 1000 m.a.s.l., which was limited to the border of Qezel Ozan River in the eastern half, Hemicryptophytes were dominant in all of the elevational zones of SPA. In the zone of 400 to 1000 m.a.s.l., therophytes were common (Fig. 12b). The destruction of vegetation may cause the predominance of therophytes in this zone due to overgrazing. The increase of therophytes due to the damage caused by anthropogenic activities and overgrazing is also observed in the results of floristic studies conducted in the Hyrcanian regions (Ghahremaninejad *et al.* 2011; Bazdid Vahdati *et al.* 2014; Ajamian *et al.* 2024). Comparing the two halves of the area in terms of the percentage of life forms showed that in the eastern half, the ratio of hemicryptophytes was almost twice that of therophytes, while in the western half, the ratio was almost equal, and both of them were dominant life forms in this half. The lowest life form in the eastern half was Chamaephytes and phanerophytes in the western half. Also, most of the samples of phanerophytes were collected from the eastern half. The ratio of geophytes and phanerophytes to other life forms was equal in both halves (Fig. 12 b).

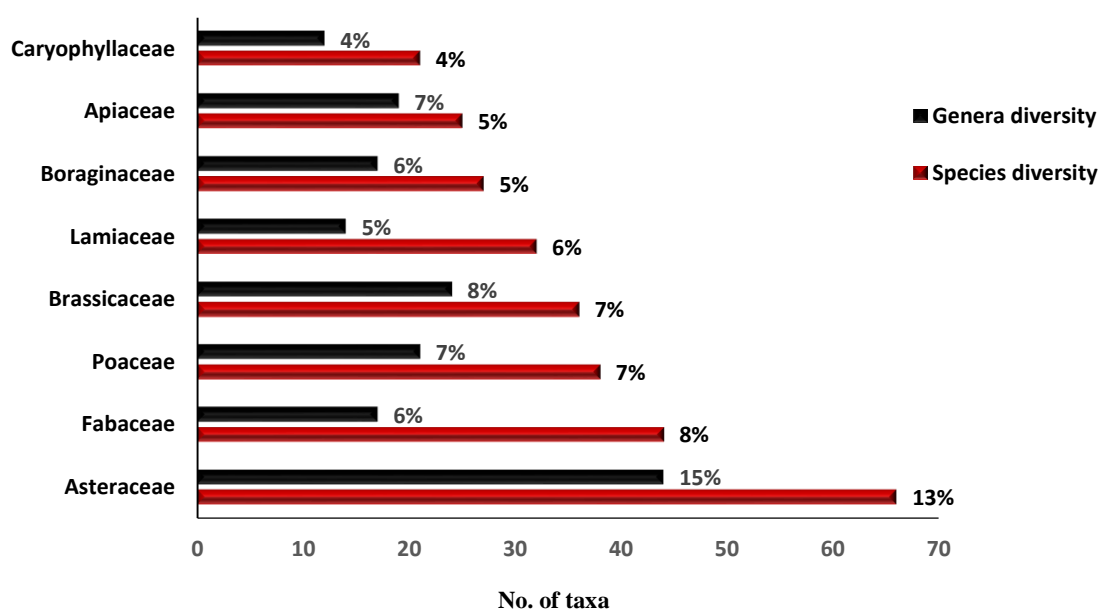
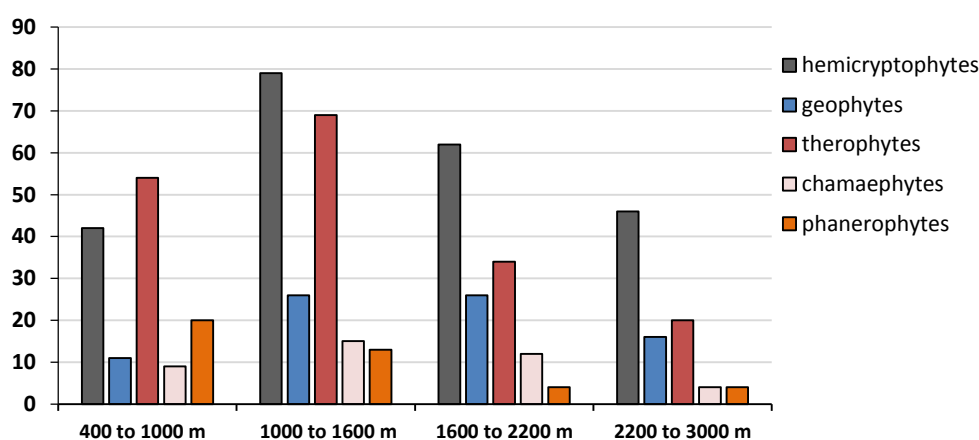


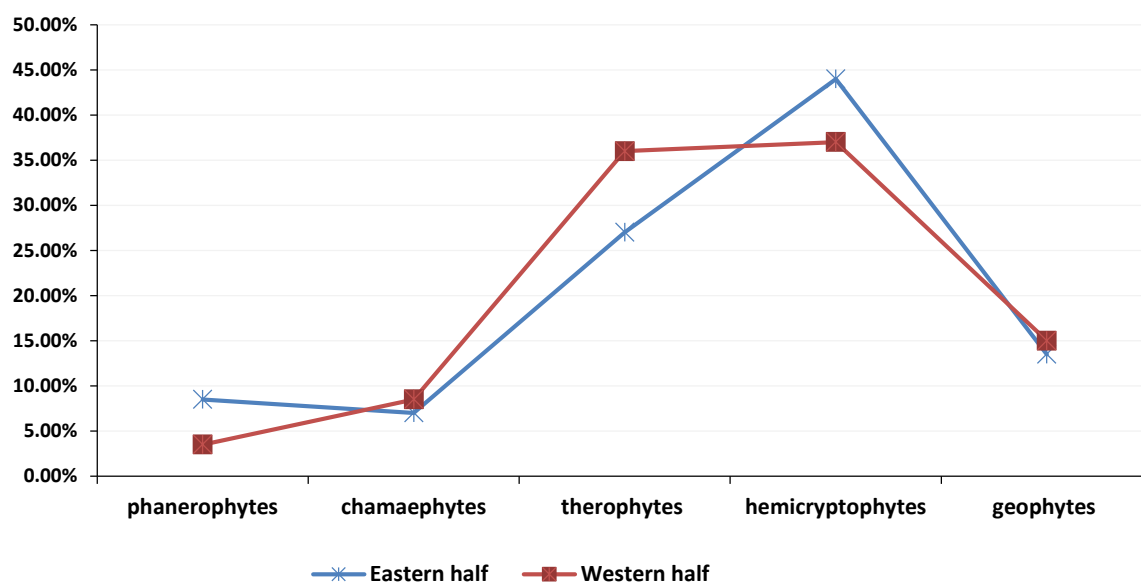
Fig. 11. The largest families in terms of diversity of vascular plant species and genera in SPA.



The predominance of plants of the Irano-Turanian region or regions shared with Irano-Turanian was quite expected considering the location of SPA in this phytogeographical region. The Irano-Turanian region shares with the Mediterranean basin numerous xerophilous plants (Bozkurt *et al.* 2022) and in this study, 12% of the plants were common between these two regions. In total 43% of the plants in the area were shared between 2 or more phytogeographical regions, which was due to the overlap of several regions or due to changes in weather conditions. By comparing the flora diversity of the study area with the adjacent protected areas, including Marakan, Lissar, and Aq-Dagh, similarities were found in dominant families and genera. Asteraceae and *Astragalus* were the largest family and genus, respectively. *Centaurea* and *Silene* were also among the large genera of these areas. In all areas, as expected, plants belonging to the Irano-Turanian region were dominant. In SPA, Aq-Dagh, and Lissar, hemicryptophytes were dominant that was followed by the therophytes, however in Marakan, therophytes were the dominant life form. In SPA, geophytes percentage were more than Chamaephytes, while in other areas, Chamaephytes were more than geophytes. Also, phanerophytes were the lowest life form in SPA and other regions. The low percentage of phanerophytes in SPA and adjacent areas showed that they were not adapted to the existing climate and edaphic situations.



a.



b.

**Fig. 12 a.** Life form spectra of the vascular plant species in different elevational zones of SPA. **b.** Comparing the eastern and western halves of the SPA in terms of distribution of life form types.

## CONCLUSION

Sorkhabad Protected Area has a variety of habitats and vegetation due to its large size and variety of geographical location and topography and this shows the importance of this protected area in terms of vegetation diversity. The present study is the first floristic study of SPA that provides baseline data for future studies, like conservation, and phytogeography, especially in the regions of Qaflankoh Mountains, Qezel Ozan River, and Zanjanrood River.

## Conflicts of interest

None declared.

This study is a part of Leila Moghanloo's Ph.D. thesis at the University of Guilan (Rasht, Iran).

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**Bibliographic information of this paper for citing:**

Moghanloo, L, Ghahremaninejad, F, Norastehnia, A, Bidarlord, M 2025, A checklist of vascular plants of the Sorkhabad Protected Area, Zanjan Province, NW Iran, *Caspian Journal of Environmental Sciences*, 23: 189-223.

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