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A floristic study of Garasmasar Mountains: Mazandaran Province, Iran

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ABSTRACT

Garasmasar mountainous area is located at 40 km southwest of Ramsar, west of Mazandaran Province, Iran with an altitude ranging from 1580 to 2850 m. The complicated topography and habitat heterogeneity led to the formation of diverse vegetation types in the area. The field data were collected by 30 phytosociology plots with an area of 25 m^2 and also field sampling. Based on this two-year samplings in this region, 426 species belonging to 211 genera and 47 families were identified. In total, dicotyledons by 349 taxa, monocotyledons by 72, pteridophyte by 3, and gymnosperms by 2 species were observed. In this area, the most richness families were Asteraceae (52 species), Poaceae (42 species), Lamiaceae (39 species), Rosaceae (34 species), Fabaceae (29 species), and Brassicaceae (28 species), respectively. The floristic composition of the area was strongly influenced by a large number of Irano-Turanian by 211 species (50%), Irano-Turanian/Euro-Siberian elements by 83 species (20%), and the pluriregional by 50 species (12%). Based on Raunkiaer life form classification, hemicryptophytes and therophytes by 58% and 19% were the dominant life forms in Garasmasar altitudes respectively. This study area is one of the most diverse and inaccessible mountainous regions on the northern slopes of the Alborz range and could be considered as a protected area in the future.

Keywords: Subalpine flora, Floristic study, Garasmasar, Ecotone, Alborz Mountain range.
Article type: Research Article.

INTRODUCTION

The knowledge of the floristic composition of an area is a prerequisite for any ecological and phytogeographical studies and conservation management activities. It is also directly related to the evolution of plants in the past. Due to the important role of plant identification in biological sciences (Stace 1989) and in recognizing natural power and better utilization of the environment, scientific identification of plants has found fundamental importance (Akbarzadeh 2007; Ataei *et al.* 2021). In various fields of science such as biology, agriculture, natural resources, which are somehow related to the plants of a region, the scientific identification of plants is of particular importance (Assareh 2006; Mirhashemi *et al.* 2021). Identifying the floristic composition of a region is a factor for a better understanding of renewable natural resources and studying diversity is essential for research in environmental sciences (Gauch & Gauch 1982; Abolhasani *et al.* 2021). To properly identifying each vegetation unit, a list of species in a community at different stages of growth periods is essential (Misra 1974; Kudryavtsev *et al.* 2021). Plant elements have always played a major role in the life cycle of other organisms and have always been used by other living organisms (Ghahreman & Attar 1999). It is commonly accepted that the conservation of all biodiversity should be our goal, and floristic studies is essential to conserving biodiversity along with managing ecosystems for long-term viability and feasibility (Mobayen 1981). There are many general floristic and vegetation studies in the Alborz range (Gilli 1939; Zohary 1973; Klein 2001; Nazarian *et al.* 2004; Noroozi

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et al. 2008; Naqinezhad *et al*. 2015). However, there are still many areas whose vegetation is less studied and considered. In recent years, many studies have been conducted in different regions of Mazandaran Province, Iran including Paband National Park (Habibi *et al*. 2013), Mazi-Bon and Si-Bon in Ramsar Protected Forests (Naqinezhad *et al*. 2010), Vaz watershed (Aghajantabar *et al*. 2015), Khybus Protected Forest (Asadi *et al*. 2011), Lomir watershed (Moradi *et al*. 2017), Samskandeh Forest Protected Area and Dashte-Naz in Sari (Ghahremaninejad *et al*. 2011). In the study area, factors such as the development of mountainous roads, entry of tourists, the transformation of rangelands into agricultural and residential lands, uncontrolled construction in recent years, and the overgrazing in rangelands have led to the destruction of biodiversity. The aims in this study are (i) to provide a complete plant list of Garasmasar altitudes and (ii) analysing them in terms of life forms, geographical distribution, and its comparison with other mountainous areas.

MATERIALS AND METHODS

Garasmasar area by about 5000 ha is located between 35º 50′ and 36º 49′ northern latitudes and 48º 10′ and 48º 15′ eastern longitudes with an altitude ranging from 1580 to 2850 m a.s.l. on southwest highlands of Mazandaran Province, Iran (Fig. 1) and 40 km southwest of Ramsar. Garasmasar village is bounded on the east by the village of Bozshi and the west by the village of Rostam-Sar, while on the north and south by the Alborz Mountain range. The study area is located on the eastern slope of Samamous Peak, the highest peak in Guilan Province. Due to the high diversity of wildlife, as well as diverse habitats and landscapes, and also since the vegetation of the sub-Alpine and Alpine regions in Central Alborz is less known, this area was chosen for our floristic studies. The Garasmasar altitudes are located in the ecoton area of the forest and rangeland of the Hyrcanian highlands. Diverse topography, deep inaccessible valleys, and vertical cliffs are among the area's fascinating landscapes and natural formations. According to available data, the average of annual precipitation and temperature were 983 mm and 16 ºC, respectively that have influenced by mountainous climate. This area has cold winters and mild summers and the highest rainfall is from early autumn to mid-winter (Fig. 2).

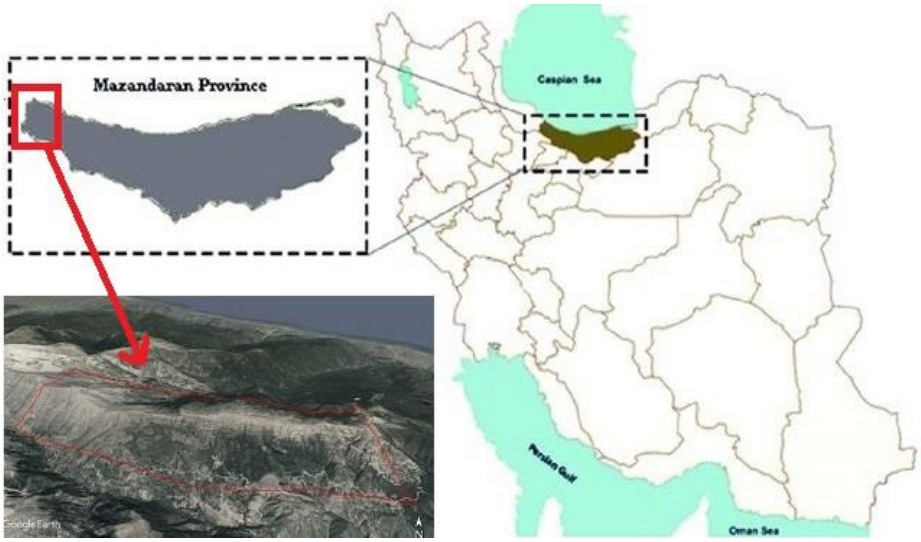

Fig. 1. Location of the study area in Garasmasar altitudes of Ramsar.

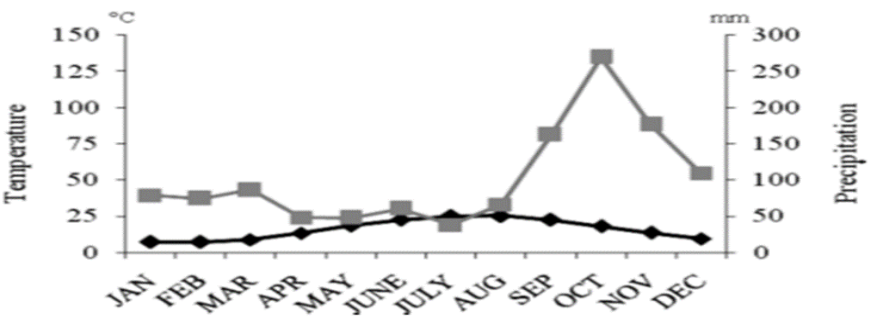

Fig. 2. The Ambrothermic diagram based on the data from Ramsar meteorological station.

Initially, to do floristic study in Garasmasar highlands, first topographic maps were prepared and access routes to the area were identified. In order to better understanding of the area, general vegetation survey and collecting plant species, field studies were conducted. The field data were collected by 30 phytosociology plots with an area of 25 m^2 and also field sampling. The phytosociology plots were carried out using a Systematic Random sampling, performing in different growing seasons during 2015 - 2016 and by collecting a total of 426 samples. For each specimen, photos were taken using a camera, followed by determining altitude and location. The habitat of each of them was carefully determined at the time of collecting. Each sample was dried according to standard methods and each was given a specific herbarium number. Then collected samples were identified accurately using the common references such as Flora Iranica (Rechinger 1963-2015), Flora of the USSR (Komarov, 1933-1964), Flora of Iraq (Townsend *et al*. 1966-1965), Flora of Turkey (Davis 1965- 1988), Flora of Iran (Assadi *et al*. 1988-2015) and Colored Flora of Iran (Ghahreman 1978-2002). The biological types were determined using Raunkiaer's method (1934) and the chorology of species by Zohary (1973) and Takhtajan (1986). All collected specimens were transferred to the herbarium of the Islamic Azad University, Ayatollah Amoli Branch, Amol, Mazandaran Province, Iran.

RESULTS AND DISCUSSION

In this study, a total of 426 taxa of vascular plants have been identified belonging to 211 genera and 47 families (Table 1). Of the total species, dicotyledons by 349 plant species, monocotyledons by 72, Pteridophyte by 3, and gymnosperms by 2 species are represented. The largest families in this area were Asteraceae (52 species), Poaceae (42 species), Lamiaceae (39 species), Rosaceae (34 species) Fabaceae (29 species) and Brassicaceae (28 species) which constitute almost 51.2% of the total taxa, so they are the most important families in this ecoton region (Fig. 3). Among the genera, *Astragalus* by11 species, *Potentilla* by 9, *Veronica* by 7, and the genera *Myosotis*, *Trifolium*, *Bromus*, *Festuca* each of them with 6 species were the richest genera.

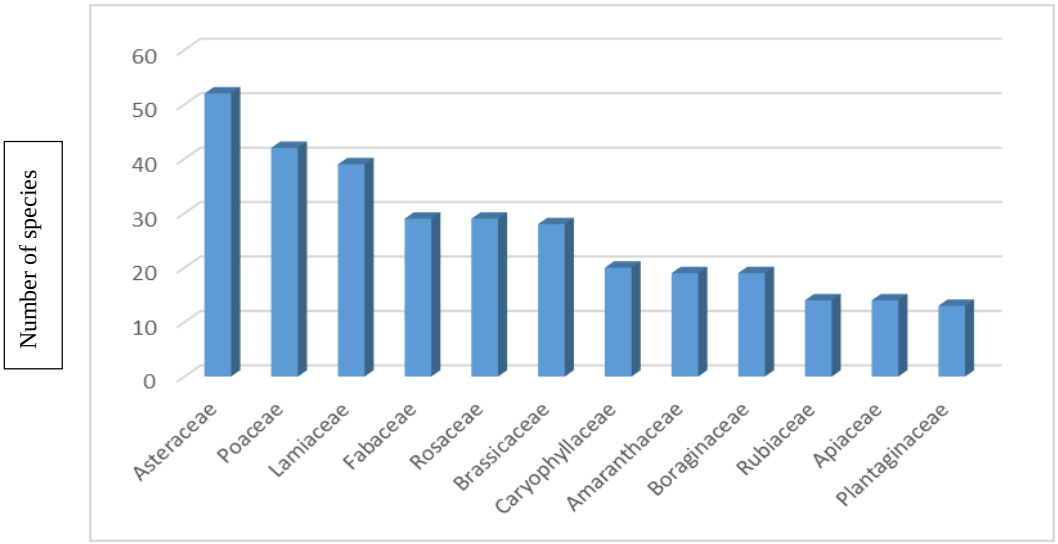

Fig. 3. Plant families and the number of species in each family in the Garasmasar region of Ramsar, Northern Iran.

Table1. List of identified taxa in Garasmasar region of Ramsar with life form and geographical distribution. Ph: Phanerophyte; Ch: Chamaephyte; Ge: Geophyte; Hem: Hemicryptophyte; Thr: Therophytes; Gb: Geophytes Bulb; Gr: Geophytes rhizome; ES: Euro-Siberian; Hyr: Hyrcanian; IT: Irano-Turanian; M: Mediterranean; PL: pluriregional.

	scientific name	Life form	Geographical distribution	Herbarium code (Ayatollah Amoli Branch, Azad University)
	Angiosperms **Eudicots** **Amaranthaceae**			

1	*Amaranthus retroflexus* L.	Thr	PL	2019-1
2	*Camphorosma monspeliaca* L.	Ch	ES, IT	2019-2
3	*Chenopodium album* L.	Thr	PL	2019-3
4	*Chenopodium foliosum* Asch.	Thr	PL	2019-4
	Apiaceae			
5	*Carum caucasicum* (M. Bieb.) Boiss.	Hem	IT	2019-5
6	*Chaerophyllum aureum* L.	Hem	IT	2019-6
7	*Chaerophyllum khorossanicum* Czerniak. ex Schischk.	Hem	IT	2019-7
8	*Diplotaenia cachrydifolia* Boiss.	Hem	IT	2019-8
9	*Eryngium caucasicum* Fisch. ex Steud.	Hem	ES, IT, M	2019-9
10	*Ferula ovina (Boiss.)* Boiss.	Hem	IT	2019-10
11	*Ferula persica* Willd.	Hem	IT	2019-11
12	*Grammosciadium scabridum* Boiss.	Hem	IT	2019-12
13	*Heracleum persicum* Desf. ex Fisch., C.A. Mey. & Avé-Lall.	Hem	IT	2019-13
14	*Pimpinella affinis* Ledeb.	Hem	PL	2019-14
15	*Pimpinella tragium* Vill.	Hem	IT	2019-15
16	*Prangos uloptera* DC.	Hem	ES, IT	2019-16
17	*Scandix iberica* M.Bieb.	Thr	IT	2019-17
18	*Seseli libanotis* (L.) W.D.J.Koch	Hem	IT	2019-18
	Apocynaceae			
19	*Vinca herbacea* Waldst. & Kit.	Hem	ES, IT	2019-19
	Asteraceae			
20	*Achillea aucheri* Boiss.	Hem	IT	2019-20
21	*Achillea millefolium* L. *subsp. millefolium*	Hem	ES, IT	2019-21
22	*Achillea vermicularis* Trin.	Hem	IT	2019-22
23	*Anthemis altissima* Guss. ex Nyman	Ch	ES, IT	2019-23
24	*Anthemis kotschyana* Boiss.	Hem	ES, IT	2019-24
25	*Anthemis triumfetti* (L.)All.	Hem	ES, IT	2019-25
26	*Artemisia absinthium* L.	Ch	ES, IT, M	2019-26
27	*Artemisia chamaemelifolia* Vill.	Hem	IT	2019-27
28	*Artemisia splendens* Willd.	Thr	ES, IT, M	2019-28
29	*Aster alpinus* L.	Ch	ES	2019-29
30	*Carduus onopordioides* Fisch. ex M. Bieb.	Hem	IT	2019-30
31	*Carduus seminudus* M. Bieb. ex M. Bieb.	Ch	IT	2019-31
32	*Carlina vulgaris* L.	Hem	IT	2019-32
33	*Centaurea leuzeoides* (Jaub & Spach) Walp.	Hem	IT	2019-33
34	*Centaurea sessilis* Willd.	Hem	ES, IT	2019-34
35	*Centaurea virgata* Lam.	Hem	IT	2019-35
36	*Centaurea zuvandica* (Sosn.) Sosn.	Hem	IT	2019-36
37	*Centaurea hyrcanica* Bornm.	Hem	ES, IT	2019-37
38	*Chardinia orientalis* (L.) Kuntze	Hem	IT	2019-38
39	*Cichorium intybus* L.	Hem	PL	2019-39
40	*Cirsium arvense* (L.) Scop.	Hem	IT, M	2019-40
41	*Cirsium echinus* (M. Bieb.) Hand.-Mazz.	Hem	IT	2019-41

42	*Cousinia chamaepeuce* Boiss.	Hem	IT	2019-42
43	*Cousinia crispa* Jaub. & Spach	Hem	IT	2019-43
44	*Cousinia pterocaulos* (C.A. Mey.) Rech. f.	Hem	ES	2019-44
45	*Crepis sancta* (L.) Bornm.	Thr	IT, M	2019-45
46	*Cyanus elbrusensis* (Boiss. & Buhse) Wagenitz & Greuter	Hem	IT	2019-46
47	*Echinops nizvanus* Rech. f.	Hem	IT	2019-47
48	*Echinops orientalis* Trautv.	Hem	IT	2019-48
49	*Erigeron acer* L.	Hem	ES, IT	2019-49
50	*Eupatorium cannabinum* L.	Hem	ES, IT	2019-50
51	*Helichrysum arenarium* (L.) Moench	Hem	IT	2019-51
52	*Helichrysum pallasii* (Spreng.) Ledeb.	Hem	IT	2019-52
53	*Inula oculus-christi* L.	Hem	IT	2019-53
54	*Inula thapsoides* Spreng.	Ch	IT	2019-54
55	*Jurinella frigida* (Boiss.) Wagenitz	Hem	IT	2019-55
56	*Lapsana communis* L.	Hem	ES, IT	2019-56
57	*Leontodon asperrimus* (Willd.) Endl.	Hem	ES, IT	2019-57
58	*Leontodon hispidus* L.	Hem	IT	2019-58
59	*Onopordum acanthium* L.	Hem	IT	2019-59
60	*Psephellus leuzeoides* (Jaub & Spach) Wagenitz	Hem	IT	2019-60
61	*Scorzonera tomentosa* L.	Thr	IT	2019-61
62	*Senecio iranicus* B.Nord.	Thr	IT	2019-62
63	*Senecio paulsenii* O.Hoffm.	Hem	IT	2019-63
64	*Solidago virga-aurea* Auct.	Hem	ES	2019-64
65	*Tanacetum parthenium* (L.) Schult Bip.	Hem	PL	2019-65
66	*Tanacetum canescens* DC.	Ch	IT	2019-66
67	*Tanacetum coccineum* (Willd.) Grierson	Ch	ES	2019-67
68	*Tanacetum kotschyi* (Boiss.) Grierson	Hem	IT	2019-68
69	*Taraxacum* sp.	Hem		2019-69
70	*Tragopogon acanthocarpus* Boiss.	Hem	IT	2019-70
71	*Tragopogon verticillatus* Lam.	Hem	IT	2019-71
	Berberidaceae			
72	*Berberis integerrima* Bunge	Ph	IT	2019-72
73	*Berberis vulgaris* L.	Ph	ES	2019-73
74	*Leontice leontopetalum* L.	Hem	IT	2019-74
	Boraginaceae			
75	*Anchusa italica* Retz.	Hem	ES, IT	2019-75
76	*Arnebia decumbens* (Vent.)Coss. & Kralik	Thr	IT	2019-76
77	*Asperugo procumbens* L.	Thr	PL	2019-77
78	*Echium amoenum* Fisch & C.A. Mey.	Hem	IT	2019-78
79	*Huynhia pulchra* (Willd. ex Roem & Schult.) Greuter & Burdet	Hem	IT	2019-79
80	*Myosotis lithospermifolia* (Willd.) Hornem.	Hem	ES	2019-80
81	*Lappula barbata* (M. Bieb.) Gürke	Thr	IT	2019-81
82	*Myosotis olympica* Boiss.	Hem	IT	2019-82
83	*Myosotis propinqua* Fisch. & C. A. Mey.	Thr	ES	2019-83
84	*Myosotis sylvatica* Ehrn.	Hem	hyr	2019-84

85	*Myosotis ramosissima* Rochel	Thr	ES	2019-85
86	*Myosotis stricta* Link ex Roem. & Schult.	Hem	IT	2019-86
87	*Nonea flavescens* Fisch. & C.A. Mey.	Thr	ES	2019-87
88	*Nonea lutea* (*Desr.*) DC.	Thr	ES	2019-88
89	*Onosma araratica* Riedl	Hem	IT	2019-89
90	*Onosma microcarpum* DC.	Hem	IT	2019-90
91	*Rochelia persica Bunge ex* Boiss.	Thr	ES, IT	2019-91
92	*Rochelia bungei* Trautv.	Thr	IT	2019-92
93	*Solenanthus stamineus* (D Esf.)Wettst.	Hem	IT	2019-93
	Brassicaceae			
94	*Alyssum desertorum* Stapf.	Thr	PL	2019-94
95	*Alyssum linifolium* Stephan ex Willd.	Thr	IT, M	2019-95
96	*Alyssum alyssoides* (*L.*) L.	Hem	ES, IT	2019-96
97	*Alyssum polycladum* Rech.f.	Ch	IT	2019-97
98	*Arabis aucheri* Boiss.	Hem	ES, IT	2019-98
99	*Arabis caucasica* Willd.	Hem	ES, IT, M	2019-99
100	*Arabis nova* Vill.	Thr	ES, IT, M	2019-100
101	*Barbarea plantaginea* DC.	Thr	IT	2019-101
102	*Capsella bursa-pastoris* (L.) Medik.	Hem	PL	2019-102
103	*Cardamine uliginosa* M. Bieb.	Thr	ES	2019-103
104	*Descurainia sophia* (L.) Webb ex Prantl	Thr	ES, IT, M	2019-104
105	*Draba nemorosa* L.	Thr	PL	2019-105
106	*Draba nuda* (Bél.) Al-Shehbaz & M. Koch	Thr	IT	2019-106
107	*Draba pulchella* Willd. ex DC.	Hem	IT	2019-107
108	*Draba rosularis* Boiss.	Ch	IT	2019-108
109	*Draba verna* L.	Thr	IT	2019-109
110	*Erysimum caucasicum* Trautv.	Hem	IT	2019-110
111	*Erysimum collinum* (M. Bieb.) Andrz. ex DC.	Ch	IT	2019-111
112	*Erysimum elbrusense* Boiss.	Hem	ES, IT	2019-112
113	*Erysimum spetae* Polatschek	Ch	IT	2019-113
114	*Isatis tinctoria* L.	Hem	IT	2019-114
115	*Lepidium draba* L.	Hem	PL	2019-115
116	*Olimarabidopsis pumila* (Celak.) Al-Shehbaz, O'Kane & R.A. Price	Thr	IT	2019-116
117	*Physoptychis caspica* V. Boczantzeva	Hem	IT	2019-117
118	*Rorippa islandica* (Oeder) Borbás	Thr	PL	2019-118
119	*Strigosella africana* (L.) Botsch.	Thr	ES, IT	2019-119
120	*Thlaspi arvensis* L.	Thr	ES, IT	2019-120
121	*Thlaspi violascens* Schott & Kotschy	Thr	IT	2019-121
	Campanulaceae			
122	*Campanula aucheri* A.DC.	Hem	IT	2019-122
123	*Campanula glomerata* L.	Hem	ES, IT	2019-123
124	*Campanula ruprechtii* Boiss.	Hem	IT	2019-124
125	*Campanula stevenii* M. Bieb.	Hem	IT	2019-125
	Caprifoliaceae			
126	*Cephalaria microcephala* Boiss.	Hem	IT	2019-126
127	*Dipsacus strigosus* Willd. Ex Roem & Schult	Hem	ES	2019-127

128	*Lonicera nummulariifolia* Jaub. & Spach	Ph	IT	2019-128
129	*Scabiosa calocephala* Boiss.	Thr	IT, M	2019-129
130	*Scabiosa caucasica* M. Bieb.	Hem	IT	2019-130
131	*Scabiosa crenata* Cirillo	Hem	IT	2019-131
	Caryophyllaceae			
132	*Arenaria dianthoides* Sm.	Hem	IT	2019-132
133	*Arenaria leptoclados* (Rchb.) Guss.	Thr	ES, IT, M	2019-133
134	*Dianthus orientalis* Adams	Hem	IT	2019-134
135	*Herniaria incana* Lam.	Thr	ES, IT, M	2019-135
136	*Holosteum umbellatum* L.	Thr	PL	2019-136
137	*Minuartia juniperina* (L.) Maire & Petitm.	Hem	IT, M	2019-137
138	*Minuartia kashmirica (*Edgew & Hook. f.) Mattf.	Hem	IT, M	2019-138
139	*Minuartia recurva* (All.) Schinz & Thell.	Hem	ES, IT	2019-139
140	*Arenaria serpyllifolia* L.	Thr	PL	2019-140
141	*Ptetrohagia saxifraga* (L.) Link.	Hem	IT, M	2019-141
142	*Scleranthus orientalis* Rössler	Thr	IT, M	2019-142
143	*Silene alba* (Mill.) E.H.L. Krause	Hem	IT	2019-143
144	*Silene aucheriana* Boiss.	Ch	IT	2019-144
145	*Silene brahuica* Boiss.	Hem	IT	2019-145
146	*Silene latifolia* Poir.	Hem	ES, IT	2019-146
147	*Silene marschallii* C.A. Mey.	Hem	IT	2019-147
148	*Stellaria holostea* L.	Ge	IT	2019-148
149	*Stellaria media* (L.) Vill.	Hem	PL	2019-149
	Cistaceae			
150	*Helianthemum nummularium* Mill.	Hem	ES, IT	2019-150
	Convolvulaceae			
151	*Calystegia silvatica* (Kit.) Griseb.	Hem	ES	2019-151
152	*Convolvulus arvensis* L.	Gr	IT, M	2019-152
	Crassulaceae			
153	*Rosularia sempervivum* (DC.) Stapf	Hem	IT	2019-153
154	*Sedum album* L.	Hem	ES, IT	2019-154
155	*Sedum stoloniferum* S. G. Gmel.	Hem	ES	2019-155
156	*Sedum subulatum* (C.A. Mey.) Boiss.	Hem	ES, IT	2019-156
157	*Sedum tenellum* M. Bieb.	Thr	ES	2019-157
	Euphorbiaceae			
158	*Euphorbia aucheri* Boiss.	Hem	IT	2019-158
159	*Euphorbia bungei* Boiss.	Hem	IT	2019-159
160	*Euphorbia denticulata* Lam.	Hem	IT	2019-160
	Fabaceae			
161	*Astragalus aegobromus* Boiss. & Hohen.	Hem	IT	2019-161
162	*Astragalus atricapillus* Bornm.	Hem	IT	2019-162
163	*Astragalus aureus* Willd.	Ch	IT	2019-163
164	*Astragalus chrysanthus* Reiche	Hem	IT	2019-164
165	*Astragalus grammocalyx* Boiss. & Hohen.	Thr	IT	2019-165

166	*Astragalus microcephalus* Willd.	Ch	IT	2019-166
167	*Astragalus modestus* Wedd.	Hem	IT	2019-167
168	*Astragalus pseudocyclophyllus* Rech.f.	Hem	IT	2019-168
169	*Astragalus rubriflorus* Bunge	Hem	IT	2019-169
170	*Astragalus schistocalyx* Bunge	Hem	IT	2019-170
171	*Astragalus verus* Olivier	Ch	IT	2019-171
172	*Coronilla orientalis* Mill.	Thr	IT, M	2019-172
173	*Coronilla varia* L.	Hem	ES, IT, M	2019-173
174	*Lathyrus incurvus* (Roth) Willd.	Thr	IT	2019-174
175	*Lathyrus pratensis* L.	Gr	PL	2019-175
176	*Lathyrus tuberosus* L.	Hem	ES, IT	2019-176
177	*Lotus corniculatus* L.	Hem	ES, IT	2019-177
178	*Medicago lupulina* L.	Hem	PL	2019-178
179	*Melilotus officinalis* (L) Pall.	Thr	PL	2019-179
180	*Onobrychis altissima* Grossh.	Hem	IT	2019-180
181	*Onobrychis bungei* Boiss.	Ch	ES, IT	2019-181
182	*Onobrychis cornuta* (L.) Desv.	Ch	IT	2019-182
183	*Oxytropis bicornis* Vassilcz.	Hem	IT	2019-183
184	*Trifolium arvense* L.	Hem	IT, ES, M	2019-184
185	*Trifolium fragiferum* L.	Gr	PL	2019-185
186	*Trifolium hybridum* L.	Hem	IT, M	2019-186
187	*Trifolium pratense* L.	Hem	PL	2019-187
188	*Trifolium repens* L.	Hem	PL	2019-188
189	*Trifolium tumens* Stev. ex M. Bieb.	Gr	Hyr, IT	2019-189
	Geraniaceae			
190	*Erodium absinthoides* Willd.	Thr	PL	2019-190
191	*Geranium divaricatum* Ehrh.	Hem	ES, IT	2019-191
192	*Geranium molle* L.	Hem	ES, IT	2019-192
193	*Geranium platypetalum* Fisch. & C.A. Mey.	Thr	ES, IT	2019-193
194	*Geranium robertianum* L.	Hem	ES	2019-194
	Hypericaceae			
195	*Hypericum androsaemum* L.	Ph	ES, IT, M	2019-195
196	*Hypericum hirsutum* L.	Hem	ES	2019-196
197	*Hypericum perforatum* L.	Hem	ES, IT	2019-197
198	*Hypericum scabrum* L.	Hem	IT	2019-198
	Lamiaceae			
199	*Clinopodium umbrosum* (M. Bieb.) K.och	Hem	ES, IT	2019-199
200	*Clinopodium vulgare* L.	Hem	ES, IT, M	2019-200
201	*Dracocephalum kotschyi* Boiss.	Hem	ES, IT	2019-201
202	*Dracocephalum aucheri* Boiss.	Hem	IT	2019-202
203	*Eremostachys macrophylla* Montbret & Aucher ex Benth.	Hem	IT	2019-203
204	*Hyssopus angustifolius* M. B.	Hem	ES, IT	2019-204
205	*Lallemantia canescens* (L.) Fisch. & C A. Mey.	Thr	ES, IT	2019-205
206	*Lallemantia iberica* (M. Bieb.) Fisch. & C.A. Mey.	Thr	ES, IT	2019-206
207	*Lamium album* L.	Hem	IT	2019-207

208	*Lamium amplexicaule* L.	Thr	ES, IT	2019-208
209	*Leonurus cardiaca* L.	Hem	ES, IT	2019-209
210	*Marrubium astracanicum* Jacq.	Thr	IT	2019-210
211	*Mentha longifolia* (L.) Hudson	Hem	PL	2019-211
212	*Nepeta cataria* L.	Hem	PL	2019-212
213	*Nepeta persica* Bioss.	Hem	IT	2019-213
214	*Nepeta racemosa* Lam.	Hem	IT	2019-214
215	*Nepeta sintenisii* Bornm.	Hem	IT	2019-215
216	*Origanum vulgare* L.	Hem	ES, IT	2019-216
217	*Phlomis anisodonta* Boiss.	Hem	End	2019-217
218	*Phlomoides laciniata* (L.) Kamelin & Makhm.	Hem	IT	2019-218
219	*Prunella vulgans* L.	Hem	ES, IT	2019-219
220	*Salvia sclarea* L.	Hem	IT	2019-220
221	*Salvia* sp.	Hem		2019-221
222	*Salvia staminea* Montbret & Aucher ex Benth.	Hem	IT	2019-222
223	*Salvia verticillata* L.	Hem	ES, IT	2019-223
224	*Satureja isophylla* Rech.f.	Ch	ES	2019-224
225	*Scutellaria pinnatifida* A. Hamilt. *subsp*. mucida	Hem	IT	2019-225
226	*Stachys byzantina* K. Koch.	Hem	ES	2019-226
227	*Stachys lavandulifolia* Vahl	Hem	IT	2019-227
228	*Stachys nivea* Labill.	Hem	IT	2019-228
229	*Teucrium chamaedrys* L.	Hem	IT	2019-229
230	*Teucrium polium* L.	Hem	ES, IT	2019-230
231	*Thymus fedtschenkoi* Ronniger	Hem	IT	2019-231
232	*Thymus kotschyanus* Boiss. & Hohen.	Ch	IT	2019-232
233	*Thymus pubescens* Boiss. & Kotschy ex Celak.	Hem	IT	2019-233
234	*Thymus transcaucasicus* Ronniger	Hem	IT	2019-234
235	*Thymus trautvetteri* Klokov & Des-Shost.	Hem	IT	2019-235
236	*Ziziphora capitata* L.	Hem	IT	2019-236
237	*Ziziphora clinopodioides* Lam.	Hem	IT	2019-237
	Malvaceae			
238	*Alcea sulphurea* (Boiss. & Hohen.) Alef.	Hem	IT	2019-238
239	*Malva neglecta* Wallr.	Hem	ES, IT	2019-239
	Orobanchaceae			
240	*Orobanche mutelii* F.W. Schultz	Ge	IT, M	2019-240
241	*Pedicularis caucasica* M. Bieb.	Hem	IT	2019-241
242	*Pedicularis sibthorpii* Boiss.	Ge	IT	2019-242
	Papaveraceae			
243	*Corydalis oppositifolia* DC.	Ge	IT	2019-243
244	*Corydalis rupestris* Kotschy.	Hem	IT	2019-244
245	*Fumaria asepala* Boiss.	Thr	IT	2019-245
246	*Papaver armeniacum* (L.) DC.	Thr	ES, IT	2019-246
247	*Papaver bracteatum* Lindl.	Hem	IT	2019-247
248	*Papaver macrostomum* Boiss. & A.Huet	Thr	ES, IT	2019-248
249	*Papaver setiferum* Goldblatt	Thr	IT	2019-249

	Plantaginaceae			
250	*Digitalis nervosa* Steud. & Hochst. ex Benth.	Hem	ES	2019-250
251	*Linaria vulgaris* Mill.	Thr	IT	2019-251
252	*Linaria genistifolia* (L.) Mill.	Thr	ES	2019-252
253	*Plantago atrata* Hoppe	Hem	ES, IT	2019-253
254	*Plantago lagopus* L.	Thr	PL	2019-254
255	*Plantago lanceolata* L.	Hem	PL	2019-255
256	*Veronica anagallis-aquatica* L.	Hem	PL	2019-256
257	*Veronica aucheri* Boiss.	Hem	IT	2019-257
258	*Veronica gentianoides* Vahl	Thr	ES, IT, M	2019-258
259	*Veronica kurdica* Benth.	Hem	IT	2019-259
260	*Veronica multifida* L.	Hem	ES, IT	2019-260
261	*Veronica orientalis* Mill.	Cha	IT	2019-261
262	*Veronica persica* Poir.	Thr	ES, IT, M	2019-262
	Plumbaginaceae			
263	*Acantholimon demavendicum* Bornm.	Ch	IT	2019-263
234	*Acantholimon hohenackeri* (Jaub. & Spach) Boiss.	Ch	IT	2019-264
	Polygalaceae			
265	*Polygala anatolica* Boiss. & Heldr.	Hem	ES	2019-265
	Polygonaceae			
266	*Polygonum alpestre* C.A.Mey.	Hem	IT	2019-266
267	*Polygonum cognatum* Meisn.	Hem	IT	2019-267
268	*Polygonum cognatum subsp. chitralicum* (Rech. f. & Schiman-Czeika) Qaiser	Thr	IT	2019-268
269	*Polygonum serpyllaceum* Jaub. & Spach	Thr	IT	2019-269
270	*Rheum ribes* L.	Hem	IT	2019-270
271	*Rumex elbrusensis* Boiss.	Hem	IT	2019-271
272	*Rumex obtusifolius* L.	Hem	ES, IT	2019-272
273	*Rumex scutatus* L.	Hem	ES, IT	2019-273
	Primulaceae			
274	*Androsace americana* Wendelbo	Hem	IT	2019-274
275	*Androsace villosa* L.	Hem	ES, IT	2019-275
276	*Androsace maxima* L.	Thr	ES, IT	2019-276
277	*Dionysia aretioides* (Lehm.) Boiss.	Hem	IT	2019-277
278	*Primula auriculata* Lam.	Hem	ES, IT	2019-278
279	*Primula heterochroma* Stapf	Hem	IT	2019-279
280	*Primula veris subsp. macrocalyx* (Bunge) Lüdi	Hem	ES	2019-280
	Ranunculaceae			
281	*Anemone caucasica* Willd. ex Rupr.	Thr	IT	2019-281
282	*Ceratocephalus testiculatus* (Crantz) Roth	Thr	ES, IT	2019-282
283	*Delphinium szowitsianum* Boiss.	Ge	IT	2019-283
284	*Ficaria kochii (*Ledeb.*)* Iranshahr & Rech.f.	Hem	ES, IT	2019-284
285	*Pulsatilla albana* (Stev.) Bercht. & J. Presl	Hem	ES	2019-285
286	*Ranunculus aucheri* Boiss	Cr	IT	2019-286

287	*Ranunculus kotschyi* Boiss.	G	IT	2019-287
288	*Ranunculus polyanthemos* L.	G	IT	2019-288
	Rhamnaceae			
289	*Frangula alnus* Mill.	Ph	ES, IT, M	2019-289
290	*Rhamnus persica* P. Lawson	Ph	IT	2019-290
	Rosaceae			
291	*Agrimonia eupatoria* L.	Hem	ES, IT	2019-291
292	*Alchemilla caucasica* Buser	Hem	ES	2019-292
293	*Alchemilla erythropoda* Juz.	Hem	IT	2019-293
294	*Alchemilla hessii* Rothm.	Hem	ES	2019-294
295	*Alchemilla sericata* Rchb. ex Buser	Thr	ES	2019-295
296	*Cerasus incana* (Pall.) Spach	Ph	IT	2019-296
297	*Cerasus pseudoprostrata* Pojark.	Ph	IT	2019-297
298	*Cotoneaster integerrimus* Medik.	Ph	IT	2019-298
299	*Cotoneaster multiflorus* Bunge	Ph	IT	2019-299
300	*Cotoneaster nummularioides* Pojark.	Ph	IT	2019-300
301	*Crataegus monogyna* Jacq.	Ph	IT	2019-301
302	*Crataegus microphylla* K.Koch	Ch	ES	2019-302
303	*Crataegus pentagyna* Waldst. & Kit. ex Willd.	Ch	ES	2019-303
304	*Fragaria vesca* L.	Gr	ES, IT	2019-304
305	*Geum kokanicum* Regal	Hem	IT	2019-305
306	*Geum urbanum* L.	Hem	ES, IT	2019-306
307	*Mespilus germanica* L.	Ph	ES	2019-307
308	*Potentilla anserina* L.	Hem	IT	2019-308
309	*Potentilla argentea* L.	Hem	IT	2019-309
310	*Potentilla bungei* Boiss.	Hem	ES	2019-310
311	*Potentilla crantzii* (Crantz) Beck ex Fritsch	Hem	IT	2019-311
312	*Potentilla hololeuca* Boiss. ex Lehm.	Hem	IT	2019-312
313	*Potentilla reptans* L.	Hem	ES, IT	2019-313
314	*Potentilla mallota* Boiss.	Hem	IT	2019-314
315	*Potentilla micrantha Ramond ex* DC.	Hem	ES, IT, M	2019-315
316	*Potentilla recta* L.	Hem	ES, IT	2019-316
317	*Prunus divaricata* Ledeb.	Ph	ES	2019-317
318	*Prunus spinosa* L.	Ph	ES	2019-318
319	*Pyrus boissieriana* Buhse	Ph	ES	2019-319
320	*Rosa canina* L.	Ph	IT	2019-320
321	*Rosa pimpinellifolia* Bunge	Ph	IT	2019-321
322	*Rosa pulverulenta* M.Bieb.	Ph	ES, IT, M	2019-322
323	*Sanguisorba minor subsp. muricata* (Spach) Nordborg	Hem	PL	2019-323
324	*Sanguisorba officinalis* L.	Hem	IT	2019-324
	Rubiaceae			
325	*Asperula glomerata subsp. condensata* (Ehrend.) Ehrend.	Ch	IT	2019-325
326	*Crucianella gilanica subsp. glauca (A. Rich. ex DC.) Ehrend.*	Hem	IT	2019-326

327	*Crucianella gilanica subsp. hirsuta* (Ehrend.) Ehrend. & *Schönb.-Tem.*	Hem	IT	2019-327
328	*Cruciata laevipes* Opiz.	Hem	ES	2019-328
329	*Cruciata taurica* (Pall. ex Willd.) Ehrend.	Hem	IT	2019-339
330	*Galium caspicum* Steven	Hem	IT	2019-330
331	*Galium ghilanicum* Stapf	Thr	IT	2019-331
332	*Galium hyrcanicum* C.A. Mey.	Hem	IT	2019-332
333	*Galium aparine* L.	Thr	ES, IT	2019-333
334	*Galium verum* L.	Hem	ES, IT	2019-334
335	*Phuopsis stylosa* (Trin.) Hook.f. ex B. D. Jacks.	Hem	ES	2019-335
	Saxifragaceae			
336	*Saxifraga paniculata* Mill.	Hem	ES	2019-336
337	*Saxifraga ramsarica* Jamzad	Hem	ES	2019-337
	Scruphulariaceae			
338	*Scrophularia nervosa* Benth.	Hem	IT	2019-338
339	*Scrophularia orientalis* Hablitz	Hem	IT	2019-339
340	*Verbascum speciosum* Schrad.	Hem	ES, IT	2019-340
341	*Verbascum punalense* Boiss. & Buhse	Hem	ES, IT	2019-341
	Solanaceae			
342	*Hyoscyamus niger* L.	Thr	ES, IT, M	2019-342
343	*Solanum americanum* Mill.	Thr	ES, IT	2019-343
	Urticaceae			
344	*Urtica dioica* L.	Hem	PL	2019-344
	Violaceae			
345	*Viola arvensis* Murray	Thr	ES, IT	2019-345
346	*Viola occulta* Lehm.	Thr	IT	2019-346
347	*Viola suavis* M. Bieb.	Hem	IT	2019-347
348	*Viola odorata* L.	Hem	IT	2019-348
349	*Viola rupestris* F.W. Schmidt	Gr	ES, IT, M	2019-349
	Monocot **Amaryllidaceae**			
350	*Allium affine* Ledeb.	Gb	IT	2019-350
351	*Allium akaka* S.G. Gmel. ex Schult. & Schult.f.	Gb	PL	2019-351
352	*Allium ampeloprasum* L.	Gb	IT	2019-352
353	*Allium capitellatum* Boiss.	Gb	IT	2019-353
354	*Allium schoenoprasum* L.	Gb	IT	2019-354
	Asparagaceae			
355	*Muscari armeniacum* Leichtlin ex Baker	Gb	IT	2019-355
356	*Muscari caucasicum* (Griseb.) Baker	Gb	IT	2019-356
357	*Muscari neglectum* Guss. ex ten.	Gb	ES, IT	2019-357
358	*Ornithogalum arcuatum* Steven	Gb	IT	2019-358
359	*Ornithogalum cuspidatum* Bertol.	Gb	ES, IT	2019-359
360	*Ornithogalum oligophyllum* E. D. Clarke	Gb	IT, M	2019-360
361	*Puschkinia scilloides* Adams	Gb	IT	2019-361
362	*Scilla siberica subsp. caucasica* (Miscz.) Mordak	Gb	Hyr	2019-362

	Colchicaceae			
363	*Colchicum kotschyi* Boiss.	Gb	IT	2019-363
364	*Colchicum speciosum* steven	Gb	ES, IT	2019-364
	Cyperaceae			
365	*Carex divisa* Huds.	Gr	PL	2019-365
366	*Carex halleriana* Asso	Gr	IT, M	2019-366
367	*Carex riparia* Curtis	Gr	ES, IT	2019-367
	Iridaceae			
368	*Iris acutiloba* C.A. Mey.	Ge	IT	2019-368
369	*Iris imbricata* fplan	Ge	IT	2019-369
	Juncaceae			
370	*Juncus acutus* L.	Hem	PL	2019-370
371	*Juncus articulatus* L.	Gr	PL	2019-371
372	*Luzula multiflora* (Ehrh.) Lej.	Hem	PL	2019-372
	Liliaceae			
373	*Fritillaria kotschyana* Herb.	Gb	IT	2019-373
374	*Gagea fistulosa* Ker-Gawl.	Gb	IT	2019-374
375	*Gagea reticulata* (Pall.) Schult. & Schult. f.	Gb	IT	2019-375
376	*Gagea confusa* A. Terr.	Gb	ES, IT	2019-376
377	*Tulipa biflora* Pall.	Gb	IT	2019-377
378	*Tulipa montana* Lindl.	Gb	IT	2019-378
	Orchidaceae			
379	*Dactylorhiza umbrosa* (Kar. & Kir.) Nevski	Gb	ES, IT	2019-379
	Poaceae			
380	*Agropyron cristatum* (L.) Gaertn.	Hem	ES, IT	2019-380
381	*Agrostis olympica* (Boiss.) Bor	Hem	IT	2019-381
382	*Alopecurus geniculatus* L.	Hem	IT	2019-382
383	*Alopecurus textilis* Boiss.	Hem	IT	2019-383
384	*Alopecurus aucheri* Boiss.	Hem	ES, IT	2019-384
385	*Avena eriantha* Durieu	Thr	ES, IT	2019-385
386	*Brachypodium pinnatum* (L.) P. Beauv.	Hem	ES, IT	2019-386
387	*Bromus danthoniae* Trin. ex C.A. Mey.	Thr	IT	2019-387
388	*Bromus gracillimus* Bunge	Thr	IT	2019-388
389	*Bromus japonicus* Thunb.	Thr	PL	2019-389
390	*Bromus tectorum* L.	Thr	PL	2019-390
391	*Bromus tomentellus* Boiss.	Hem	ES, IT	2019-391
392	*Bromus tomentesus* Boiss.	Thr	IT	2019-392
393	*Dactylis glomerata* L.	Hem	ES, IT	2019-393
394	*Dactylis glomerata* subsp. *hispanica* (Roth) Nyman	Hem	ES, IT	2019-394
395	*Elymus repens* (L.) Gould	G	PL	2019-395
396	*Eremopoa persica* (Trin.) Roshev.	Thr	IT, M	2019-396
397	*Festuca ovina* L.	Hem	PL	2019-397
398	*Festuca pinifolia* (Hack. ex Boiss.) Bornm.	Hem	ES	2019-398

399	*Festuca pratensis* Huds.	Gr	ES	2019-399
400	*Festuca rubra* L.	Hem	PL	2019-400
401	*Festuca alaica* Drobow	Hem	ES, IT	2019-401
402	*Festuca rupicola* Heuff.	Cha	PL	2019-402
403	*Hordeum violaceum* Boiss. & Hohen.	Hem	IT	2019-403
404	*Koeleria cristata* Pers.	Hem	PL	2019-404
405	*Lolium rigidum* Gaudin	Tht	IT, M	2019-405
406	*Lolium perenne* L.	Hem	PL	2019-406
407	*Melica persica* Kunth	Hem	ES, IT	2019-407
408	*Milium vernale* M.Bieb.	Thr	PL	2019-408
409	*Oryzopsis molinioides* (Boiss.) Hack. ex Paulsen	Hem	IT	2019-409
410	*Panicum miliaceum* L.	Thr	PL	2019-410
411	*Phleum montanum* K.Koch	Thr	IT	2019-411
412	*Phleum paniculatum* Huds.	Thr	ES, IT, M	2019-412
413	*Poa annua* L.	Thr	PL	2019-413
414	*Poa alpina* L.	Gr	ES, IT	2019-414
415	*Poa angustifolia* L.	Hem	IT	2019-415
416	*Poa bulbosa* L.	Gb	PL	2019-416
417	*Poa pratensis* L.	Hem	PL	2019-417
418	*Sesleria phleoides* Steven ex Roem. & Schult.	Hem	IT	2019-418
419	*Stipa bromoides* (L.) Dörfl.	Hem	IT	2019-419
420	*Stipa orientalis* Trin. ex Ledeb.	Hem	IT	2019-420
421	*Trisetum rigidum* (M. Bieb.) Roem. & Schult.	Hem	IT	2019-421
	Gymnosperms **Cupressaceae**			
422	*Juniperus communis* L.	Ph	IT	2019-422
423	*Juniperus sabina* L.	Ph	IT	2019-423
	Pteridophytes **Aspleniaceae**			
424	*Asplenium trichomanes* L.	Gr	PL	2019-424
	Polypodiaceae			
425	*Polypodium vulgare* L.	Gr	PL	2019-425
	Woodsiaceae			
426	*Athyrium filix-femina* (L.) Roth	Gr	PL	2019-426

The area is composed of several vegetation types including grassland, shrub, and tree. The dominant life-form of plant species is Hemicryptophyte (58%), followed by Therophytes (19%), Geophytes (11%), Chamaephyte (7%), and Phanerophyte (5%; Fig. 4). The chorological studies indicate that the most considerable species belong to Irano-Turanian region 50% (211 species) and then Irano-Turanian/Euro-Siberian by 20% (83 species), Pluriregional by 12% (50 species). Euro-Siberian 9% (40 species) and Euro-Siberian / Irano-Turanian / Mediterranean by 5% (20 species), Irano-Turanian / Mediterranean 4% (16 species) and finally Hyrcanian and Hyrcanian/ Irano-Turanian by each other less than 1% (3 species) include Phytogeographic elements of this area (Fig. 5).

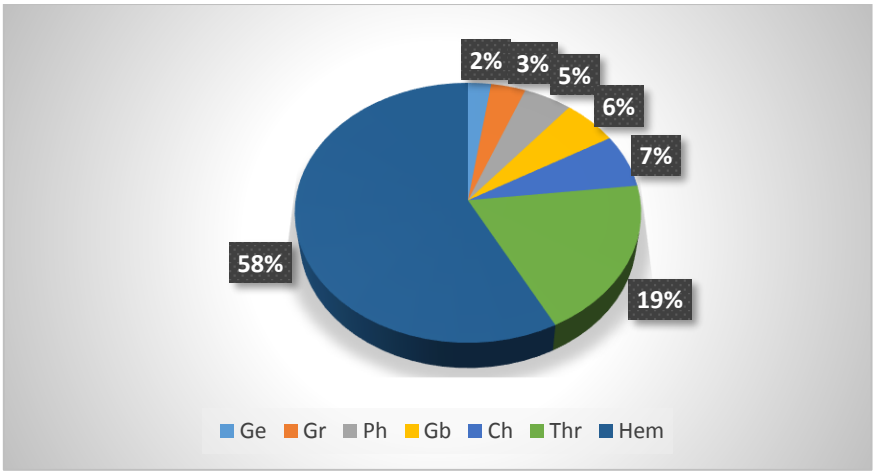

Fig. 4. Life form spectrum of plant species in the study area. Ph: Phanerophytes; Ch: Chamaephytes; Ge: Geophytes; Hem: Hemicryptophytes; Thr: Therophytes; Gb: Geophytes Bulb; Gr: Geophytes rhizome.

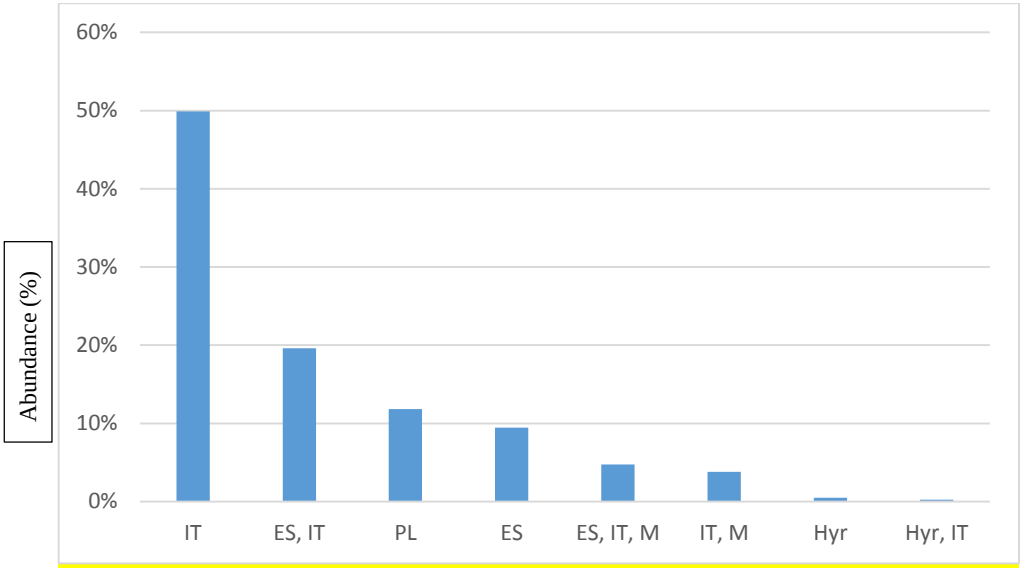

Fig. 5. Chorotype spectrum in Garasmasar area. ES: Euro-Siberian; Hyr: Hyrcanian; IT: Irano-Turanian; M: Mediterranean; PL: Pluriregional.

CONCLUSION

The high number of plant species in the study area (426 species) indicates favourable biological conditions and a high potential for biodiversity. In general, life forms are different in each plant community, and in fact, this diversity in life forms is the basis of the structure of plant communities. Families Asteraceae, Poaceae, Lamiaceae, Rosaceae, Fabaceae, Brassicaceae are the most important families of plant species in the region. The abundance of Asteraceae in the region, which is also the largest plant family in the flora of Iran (Ghahreman & Attar 1999), indicates its importance in this region. Some of the genera of this family are thorny and resistant to grazing and could be indicative of overgrazing of each area (Zohary 1973) and also have a high tolerance for ecological changes (Archibold 1995). Due to the existence of steppes in this area, Poaceae is the second richest family in the region, since all steppe regions are known with this family (İkinci and GÜNER 2007). Most of these families have been pointed out in the other studies with similar climatic conditions including Ghahremaninejad *et al*. (2012) in Lisar, Ahvazi; Mozaffarian (2015) in Roodbar Alamut region and Salehi *et al*. (2014) in Neka summer rangelands. The Garasmasar region is geographically placed between two main phytogeographic regions including Hyrcanian and Irano-Turanian. So that, over 70% of the observed taxa in this area belong to these regions. As shown in previous studies (Jafari & Akhani 2008; Naderi *et al*. 2012; Ghahremaninejad *et al*. 2012), by increasing altitude, the ratio of Irano-Turanian elements to other phytogeographical elements upraises. The significant presence of Euro-Siberian elements in this region indicates the favourable growing conditions for the distribution of these

plants. Also, the presence of vegetative elements from Irano-Turanian, Euro-Siberian, and Mediterranean regions in Garasmasar has emphasized the relationship between continent with plant distribution and species composition. It is concluded that the area is characterized by high plant biodiversity. In terms of life forms, hemichryptophytes and therophytes are the dominant life forms. The plant life forms indicate the possibility of adaptation of plants to environmental factors especially climatic conditions. According to Archibald (1995), the presence of therophyte plants is due to the Mediterranean climate and the frequency of hemichryptophyte is expected to be in a cold and temperate climate. Due to the fact that the life forms of plants show the climate of the study area, the presence of hemicryptophytes and therophytes among the plants of this region indicates the effect of two types of Mediterranean climate and cold weather on them. These outcomes are similar to the discoveries of other authors (Naqinezhad *et al*. 2009; Noroozi *et al*. 2010) in mountainous ecosystems, exhibiting that by increasing altitude, the rate (%) of hemicryptophytes upraised. It reflects the high tolerance of these plants to harsh climates and various adaptations in terms of anatomy, physiology, and morphology by preventing the water loss and water deficiency tolerance (Hamzeh 1995). The results show that the majority of life forms are hemicryptophytes by 50%, one of the reasons is the high tolerance of these plants to the arid climate and different adaptations in terms of anatomy, physiology, and morphology which prevents water wastage and tolerate water deficiency. The presence of cushion plants in the region is significant that one of the reasons for the presence of this vegetation type is overgrazing, leading to the biodiversity loss and soil erosion (Noroozi *et al.* 2008). Expansion of roads, uncontrolled grazing, land-use changing, and the presence of tourists in the area, waste disposal, and environmental pollution are some of the threats to vegetation.

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