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Natural Plants for Use in Rock and Dry Wall Gardens at High Altitude Areas

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Abstract: This study was carried in order to determine some natural plant species, which include high potential for use in rock and dry wall gardens, in the Palandoken mountains. 10 sampling areas with the altitudes of 2100 and 3176 m were selected to conduct the study in the period May 1997 to September 1998. *In situ* plant surveys, floristical plant analyses and species sampling plots were used in the study. During the study, 166 plant species belonging to 32 families were examined, of which 114 alpine plant species belonging to 30 families were found to be important in terms of use in rock and dry wall gardening.

Key words: Rock and dry wall gardens, plant use, alpine plants, natural plants, Palandoken mountains, Turkey

Introduction

Natural plant species have a great importance for use in landscape planning and design (Korkut, 1993; Yilmaz *et al.*, 2000). They have also a supplementary function in natural habitats as well as geological structure, soil, climate and hydrological structure. On the other hand, the natural plants are crucial materials for landscape architecture in terms of the conservation, developing, restoration and management of landscape (Bayraktar, 1980).

In recent years, increasing environmental awareness started to conserve the alpine plants *in situ*, in collection gardens, seed banks and botanic gardens (Schubert *et al.*, 1990). The Royal Botanic Garden, the Brooklyn Botanic Garden and the Denver Botanic Garden are among important gardens with their alpine plant collections (Ekim, 1991 and Percin, 1997). In botanic gardens, the species of alpine plants have been displayed in rock gardens (Good, 1996).

In general, the plants growing in the alpine areas are appropriate for use in rock gardens. The alpine plants are generally compact plants with a height under 15 cm. Most rock garden plants grow in the areas above the forest restriction (Kelly, 1971; Brickell, 1992; Means, 1994). Rock gardens are designed for rock plants or the alpine plants. Using the morphology of land as much as possible, dry wall gardens have been made up of fixed rocks, putting stones one above another or site by site and placing plants with different color and form among these stones (Harper, 1977; Bubel, 1984; Loewer, 1984; Guclu, 1988; Brickell, 1996). Foster (1968, 1978), Richardson (1970) and Brickell (1996) studied on determining the alpine and the other natural plants which can be used in rock gardens. Rock gardens are designed in the areas open to sunlight. The flora of Turkey has a striking biodiversity of alpine plants in mountainous areas with high altitudes. There have been few studies on the natural plants in the mountainous areas in Turkey, in spite of being equipped

with rich natural plants, which can be used in rock and dry wall gardens (Guclu, 1988).

This study depends on the studies of flora and vegetation by some researches such as Cetik and Tatli (1975), Akman *et al.* (1983a, b), Tatli (1988, 1989a, b), Aksoy (1989), Tatli and Behcet (1989), Walker *et al.* (1994), Sadlo and Kolbek (1994), Bock *et al.* (1995) and Taye (1995).

The number of plants which can be used in garden design in Erzurum is limited because of extreme ecological conditions. For this reason, the natural plants, growing in the region are important. In this study, the alpine plants suitable for use in rock and dry wall gardens in Erzurum were determined.

Materials and Methods

The research material was selected among the alpine plants growing in 10 different locations, of which altitudes vary between 2100 and 3176 m, within the B₈ square, suggested by Davis (1965-1985) for Turkey (Fig. 1).

The study consists of two stages of land survey and office assessment. In the land survey, the floristical plant analysis (Guclu, 1988; Korkut, 1993) and species sampling plots method (Braun-Blanquet, 1932) were used.

During the vegetation period of May 1997 to September 1998, the plants were observed once a fortnight. First blooming time, blooming duration, vertical and horizontal

Table 1: Observation scheme for species investigation

Date of Survey:
Location of Survey: 1,2,3,.....10
Family and Species:
Habitat: Meadow / Creek / Stony Slope / Roadway Side / Meadow with Peat / Degenerated Pasture
Topographic Conditions: Altitude / Aspect / Slope
Horizontal and Vertical Plant Height (cm):
Plant Form: Spherical / Vertical / Sculptured / Covering / Compact / Round / Bush
Blooming Characteristics: Blooming Date/ Flowering Period / Bloom Color / Blooming Quality
Other Plant Species in the Survey Area:
Endemicity:

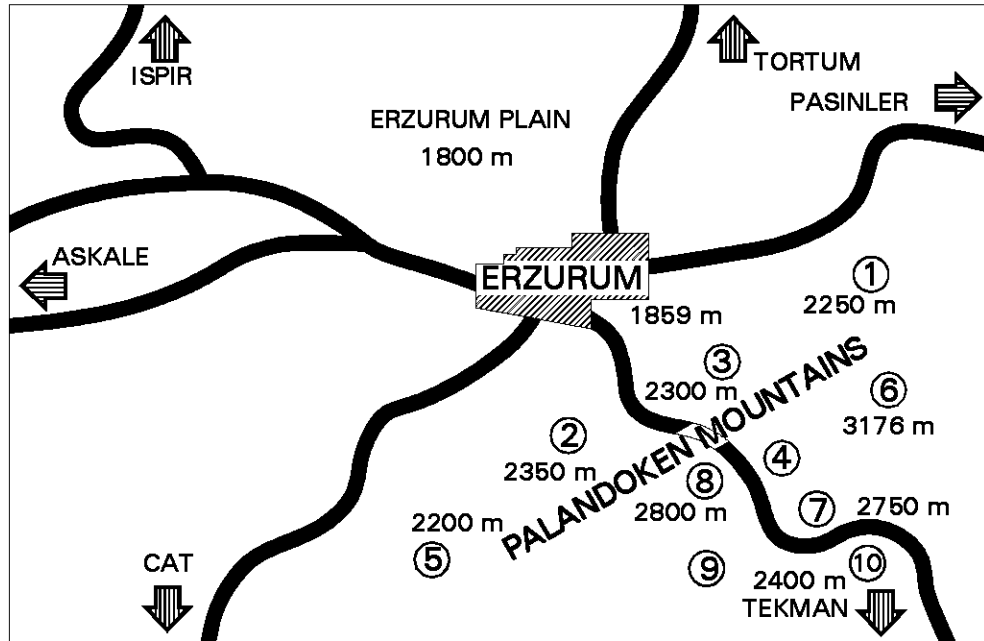


Fig. 1: Sampling areas for plant species investigation

Table 2: Sampling Locations and Characteristics

1	Abdurrahman Gazi Tomb: 2250-2300 m. The north-northwest slopes have been afforested. Soil is clay loam.
2	Palandoken Reforestation Area: 2250-2450 m. West aspect of Palandoken ski-resort area. The southeast slopes of the area are eroded and covered with stones. Inside the reforested area is covered by green.
3	Reforestation Area in the East Side of The Plan Hotel: 2100-2450 m. Slope gradient is 40-45 % in the north and northeastern slopes. Deep-valley slopes are severely eroded. Since the area is protected from grazing vegetation is in good condition. Soil is clay loam.
4	The Dedeman Hotel Surrounding: 2300-2450 m. Since the area is protected from grazing, vegetation is in good condition in the north and northeastern slopes. Soil is loamy.
5	Teke Creek: 2250-2350 m. The research was conducted on west-northwest slopes. The study area is covered by stones. Soil is loamy.
6	Ejder Peak: 2900-3167 m. The area is severely eroded and slope is over 45 %. Soil is loamy. Vegetation is poor.
7	500 m Southwest of Ejder Peak: 2600-2900 m. The area is covered with alpine grass. Vegetation is degenerated by overgrazing. Summit position of the area and south slopes are completely covered by stones. Soil is loamy.
8	1 km southwest of Ejder Peak (North Slope): 2750-2800 m. Ground water level is very high in the area until September. Area is very rich in peat material. North slopes are dominated by alpine grass.
9	1 km southwest of Ejder Peak (South Slope): 2600-2800 m. The area is overgrazed and moderately eroded. Soils are sandy at the bottom parts of the valley, and clay loam in the other parts.
10	Tekman-Incesu Village Intersection: 2400-2450 m. The area is almost flat with slightly sloping on south aspects. Soil are loamy, except creek costs.

growing, plant forms, habitat properties and the other properties such as Endemicity, bloom color and life time of plants were recorded down in identification forms shown in Table 1 and later on the data were assessed.

The diagnosis of plant samples obtained from the searching area was prepared in the herbarium at the Department of Botany, Atatürk University, Erzurum. The soil samples obtained within 0-20 cm. depth were analysed in the Soil Analysis Laboratory at the Rural Affairs Directorate in Erzurum (Table 2). The altitude of the study locations were measured with the aid of a precision altimeter.

The life span and life forms of the plants were determined according to Andic (1985), Akman and Ketenoglu (1987). The endemic properties of the plants was also considered

(Anonymous, 1989).

The habitat properties, first blooming date, blooming duration, vertical and horizontal growing, plants form, plants heights, color of bloom were considered for the use in rock and dry wall gardens (Foster, 1968; Guclu, 1988; Brickell, 1992).

Results

In the study, 133 plant species belonging to 32 families originally from Irano-Turanian were assessed in terms of rock and dry wall gardening. Among them 114 alpine plant species belonging to 30 families were found to be important. The species, lifetime, life form, endemicity form, blooming period, bloom color and average plant height of the plants are given in Table 3.

Table 3: Some alpine plants in the Palandoken mountains important in terms of rock and dry wall gardening

Angiospermae Dicotyledoneae Families and Species	Habitat	Ll	Lf*	E*	Plant form	Average plant Height (cm)	Blooming Duration				Bloom Color
							M	J	JI	A	
BORAGINACEAE											
<i>Alkanna orientalis</i> (L.) Boiss		B	T	R	Spherical	20-40		x	x		Yellow
<i>Anchusa azurea</i> Miller		B	T	-	Vertical	20-80	x	x	x		Blue
<i>Myosotis alpestris</i> F. W. Smith.	6-7-8	P	T	-	Vertical	5-15			x		Blue
<i>Onosma armenum</i> DC.	10	P	H	nt	Spherical	40-60		x	x		Yellow-Green
CAMPANULACEAE											
<i>Campanula glomerata</i> L. ssp. <i>hispida</i>	3	P	H	-	Vertical	20-60		x	x		Blue-Purple
<i>Campanula rapunculoideis</i> L.	3	P	H	-	Vertical	20-80		x	x		Blue-Purple
<i>Campanula stricta</i> L.	2-3	P	H	R	Vertical	20-50			x		Blue
<i>Campanula tridentata</i> Schreber	9	P	H	-	Compact	5-15		x	x		Blue-Purple
CARYOPHYLLACEAE											
<i>Araneria dianthoides</i> Smith.	4	P	H	-	Compact	10-20			x	x	White
<i>Araneria gypsophiloideis</i> L.	4	P	Ch	-	Compact	10-20			x	x	White
<i>Cerastium gnaphaloideis</i> Fenzl.	6-9	P	Ch	nt	Compact	10-20			x	x	White
<i>Dianthus floribundus</i> Boiss.	4	P	Ch	-	Compact	10-15			x	x	White
<i>Dianthus multicaulis</i> Boiss and Huet	4	P	Ch	-	Compact	10-15		x	x		Pink
<i>Minuartia recurva</i> (All.) Schinz and Thell.	4-7	P	Ch	R	Compact	5-10	x	x			White
<i>Silene bupleuroides</i> L.	2-3	P	Ch	-	Spherical	20-30			x	x	Pink
<i>Silene pungens</i> Boiss.	2-3	P	Ch	-	Spherical	20-30			x	x	White
CHENOPODIACEAE											
<i>Chenopodium foliosum</i> (Moench) Aschers	2	P	T	-	Sculptured	20-70		x	x	x	Red
COMPOSITAE											
<i>Achillea biebersteinii</i> Afan.	4	P	Ch	-	Vertical	15-40		x	x	x	Yellow
<i>Achillea millefolium</i> L. ssp. <i>millefolium</i>	4	P	Ch	-	Vertical	15-40	x	x	x		White
<i>Anthemis tinctoria</i> L.	4-10	P	H	R	Vertical	20-30		x	x		Yellow
<i>Artemisia spicigera</i> C. Koch.	4	P	Ch	-	Bush	15-40					
<i>Aster alpinus</i> L.	3	P	H	-	Vertical	15-30		x	x		Blue-Lilac
<i>Centaurea depressa</i> Bieb.		P	H	-	Vertical	15-50		x	x		Blue-Purple
<i>Centaurea pulcherrima</i> Willd.	4	P	H	R	Vertical	20-60			x	x	Red-Pink
<i>Centaurea sessilis</i> Willd.	4-10	P	H	nt	Compact	5-10		x	x		Yellow
<i>Erigeron caucasicus</i> Stev.	3-4	B	T	-	Vertical	10-25		x	x	x	Red-Pink
<i>Helichrysum callicrysium</i> Fisch. and Mey.		P	H	-	Vertical	20-60		x	x	x	Yellow
<i>Helichrysum plicatum</i> DC. subsp. <i>plicatum</i>	4	P	H	-	Vertical	20-40		x	x	x	Yellow
<i>Jurinella moschus</i> (Habliz) Bobrov <i>moschus</i>	4	P	H	-	Compact	5-10		x	x		Purple
<i>Senecio vernalis</i> Waldst and Kit.	4	A	H	-	Vertical	25-50		x	x	x	Yellow
<i>Tanacetum abrotanifolium</i> (L.) Druce.	7	P	H	-	Compact	5-20			x	x	Yellow
<i>Tragopogon bupthalmoides</i>	9	B(P)	T	-	Vertical	20-40		x	x	x	Yellow
<i>Xeranthemum annuum</i> L.	2	A	T	-	Vertical	10-20			x	x	Pink
CRASULACEAE											
<i>Sedum atratum</i> L.	7	p	Ch	-	Covering	5-10			x	x	Red
<i>Sempervivum montanum</i> L.	2	P	Ch	-	Covering	5-15			x	X	Red
CRUCIFERAE											
<i>Aethionema armena</i> Boiss.	6-10	P	H	-	Compact	10-20		x	x		Pink
<i>Alyssum pateri</i> Nyar	10	P	Ch	nt	Compact	5-15		x	x		Yellow
<i>Alyssum murale</i> Willd.	4	P	Ch	-	Compact	5-15		x	x		Yellow
<i>Arabis caucasica</i> Willd. subsp. <i>caucasica</i>	6	P	Ch	-	Compact	10-20		x	x		White
<i>Draba brunii</i> Stev. subsp. <i>brunii</i> <i>folia</i>	2	P	Ch	R	Compact	5-20	x	x			Yellow
<i>Isatis tinctoria</i> L.		B	T	-	Spherical	30-80		x	x		Yellow

Table 3: Continuous

Angiospermae Dicotyledoneae Families and Species	Habitat	Ll	Lf*	E*	Plant form	Average plant Height (cm)	Blooming Duration				Bloom Color
							M	J	JI	A	
EUPHORBIACEAE											
<i>Euphorbia virgata</i> Wald. et Kit	15	P	H	-	Vertical	30-80		x	x	x	Yellow-Green
GENTIANACEAE											
<i>Gentiana lutea</i> L.	7-8	P	Ch	-	Compact	5-10		x	x		Dark blue
<i>Gentiana verna</i> L.	7-8	P	Ch	-	Compact	5-10		X	x		Dark blue
GERANIACEAE											
<i>Erodium absinthoides</i> Willd.	9	P	Ch	nt	Compact	5-10		X	x	x	Blue
GUTTIFERAE											
<i>Hypericum hyssopifolium</i> Chaix	4	P	H	-	Vertical	10-30		x	x		Yellow
<i>Hypericum linarioides</i> Bosse.	4	P	H	-	Vertical	10-20		x	x	x	Yellow
<i>Hypericum perforatum</i> L.	2	P	H	-	Bush	20-40		x	x		Yellow
<i>Hypericum scabrum</i> L.	2	P	H	-	Bush	20-40		x	x		Yellow
LABIATAE											
<i>Ajuga chamaepitys</i> (L.) Schr.		P	H	R	Covering	5-15		x	x		Yellow
<i>Ajuga reptans</i> L.	2	P	H	-	Vertical	10-20	x	x			Purple
<i>Nepeta racemosa</i> Lam		P	Ch	-	Vertical	20-50		x	x		Purple
<i>Salvia candidissima</i> Vahl.	3-4	P	H	-	Vertical	30-60		x	x		White
<i>Salvia verticillata</i> L.	3-10	P	Ch	-	Vertical	30-60		x	x		Purple
<i>Scutellaria orientalis</i> L.	4	P	Ch	nt	Covering	5-10		x	x		Yellow
<i>Stachys lavandulifolia</i> Vahl.	3-4-10	P	H	-	Vertical	10-30		x	x		Pink
<i>Teucrium orientale</i> L.	2-3	P	Ch	-	Spherical	20-40		x	x		Purple
<i>Thymus falka</i> Fisch. and Mey.	3-4-7-9	P	Ch	-	Compact	5-10		x	x	x	Pink
LYTHRACEAE											
<i>Lythrum salicaria</i> L.	2	P	H	-	Vertical	40-150			x	x	Red
LEGUMINOSAE											
<i>Astragalus lagurus</i> Willd.	3	P	Ch	-	Round	30-60		x	x		White
<i>Astragalus lineatus</i> Lam		P	H	nt	Covering	10-15		x	x		Red
<i>Astragalus microcephalus</i> Willd.	9	P	Ch	-	Round	15-30					
<i>Cicer anatolicum</i> Boiss.	3	A	T	-	Spherical	20-40		x			Purple
<i>Coronilla orientalis</i> Miller var. <i>orientalis</i>	1	P	H	-	Covering	10-20	x	x	x		Yellow
<i>Lotus corniculatus</i> L. var. <i>corniculatus</i>	4	P	H	-	Covering	5-10		x	x		Yellow
<i>Onobrychis cornuta</i> L.	9	P	Ch	-	Round	20-40		x	x		Red
<i>Trifolium repens</i> L.	9	P	H	-	Covering	15-30	x	x	x		White
<i>Vicia alpestris</i> Stev.	6	P	T	nt	Covering	15-25			x	x	Red
PAPAVERACEAE											
<i>Glacium corniculatum</i> (L.) Rudolph.		A	T	-	Spherical	40-80		x	x		Orange
<i>Papaver dubium</i> L.	4	A	T	-	Vertical	20-50		x	x	x	Orange
<i>Papaver rhoeas</i> L.		A	T	-	Vertical	20-40	x	x	x		Red
PLUMBAGINACEAE											
<i>Acantholimon acaerosum</i> (Willd.) Boiss.	4	P	Ch	nt	Round	20-40			x	x	Pink
<i>Acantholimon caryophyllaceum</i> Boiss.		P	Ch	R	Round	20-40			x	x	White-Pink
POLYGONACEAE											
<i>Polygonum bistorta</i> L.	7-8	P	H	-	Vertical	5-50			x	x	Red
<i>Rumex acetosella</i> L.		A	G	-	Vertical	30-50		x	x		Red
PRIMULACEAE											
<i>Androsace villosa</i> L.	7	P	H	-	Compact	5-15		x	x		White
<i>Primula auriculata</i> Lam	2-8-9	P	H	-	Vertical	20-40	x	x	x		Pink-Red

Table 3: Continuous

Angiospermae											
Dicotyledoneae											
Families and Species	Habitat	Ll	Lf*	E*	Plant form	Average plant Height (cm)	Blooming Duration				Bloom Color
							M	J	JI	A	
RANUNCULACEAE											
<i>Anemone narciflora</i> L.	7	P	G	-	Vertical	8-15	x	x			White
<i>Anemone albana</i> Stev.	1-7	P	H	-	Vertical	8-25	x	x			Lilac
<i>Caltha palustris</i> L.	2-9-10	P	H	-	Spherical	20-30	x	x			Yellow
<i>Consolida orientalis</i> (Gay) Schröd.		A	H	-	Vertical	20-40	x	x			Purple
<i>Ranunculus brachylobus</i> Boiss and Hoh.	6-7	P	H	-	Vertical	5-30	x	x			Yellow
<i>Ranunculus ficaria</i> L.		P	G	-	Compact	3-5	x	x			Yellow
<i>Ranunculus grandiflorus</i> L.		P	H	-	Vertical	20-40	x	x			Yellow
ROSACEAE											
<i>Alchemilla caucasica</i> Buser.	7	P	H	-	Compact	5-10			x	x	Yellow-Green
<i>Alchemilla sintenisii</i> Rothm	7	P	H	R	Compact	10-40			x	x	Yellow-Green
<i>Cotoneaster nummularia</i> Fisch. and Mey.	2	P		-	Bush	40-100		x	x		White
<i>Potentilla bifurca</i> L.	3-7	P	H	-	Compact	10-25		x	x		Yellow
<i>Rosa canina</i> L.	3	P		-	Bush	20-150		x	x		White-Red
RUBIACEAE											
<i>Cruciata taurica</i> (Pallas and Willd.) Ehrend.	6	P	H	-	Compact	15-40		x	x		Yellow-Green
<i>Galium verum</i> L.	2-3-4	P	H	-	Vertical	30-60		x	x		Yellow
SAXIFRAGACEAE											
<i>Saxifraga paniculata</i> Mill.	7	P	H	-	Compact	3-8		x	x		White
SCROPHULARIACEAE											
<i>Pedicularis comosa</i> L.	7	P	H	-	Vertical	5-60	x	x	x		White
<i>Verbascum cherianthifolium</i> Boiss.	3	P	T	nt	Sculptured	40-120		x	x		Yellow
<i>Veronica gentianooides</i> Vahl.	7	P	Ch	R	Vertical	5-60	x	x	x		Blue
<i>Veronica multifida</i> L.	6	P	Ch	-	Covering	5-20		x	x		Blue
<i>Veronica orientalis</i> Mill.		P	Ch	R	Covering	5-15	x	x	x		Blue
VALERIANACEAE											
<i>Valeriana leucophaea</i> DC.	7	P	H	-	Vertical	10-40		x	x		White
VIOLACEAE											
<i>Viola tricolor</i> L.	8	P	H	-	Compact	5-10		x	x	x	Purple-Yellow-White
MONOCOTYLEDONEAE											
IRIDACEAE											
<i>Gladiolus atraviolaceus</i> Boiss.		P	G	-	Vertical	40-100	x	x			
<i>Rediris caucasica</i> Hoffm	2	P	G	-	Vertical	20-30	x	x			Yellow
LILIACEAE											
<i>Colchicum nivale</i> Boiss. and Huet.	1	P	G	-	Compact	3-8	x				White
<i>Gagae bulbifera</i> Schultes	1	P	G	-	Compact	5-10	x				Yellow
<i>Gagae glacialis</i> C. Koch.		P	G	-	Compact	5-10	x				Yellow
<i>Muscari armeniacum</i> Leic. and Baker	2	P	G	-	Vertical	10-20	x	x			Blue
<i>Ornithogalum sigmoideum</i> Freyn and Sint.	2-9	P	G	-	Compact	5-15	x	x			White
<i>Scilla siberica</i> Haw. subsp. <i>armena</i> (Grossh.)	1-2	P	G	-	Compact	5-15	x	x			Blue
<i>Fritillaria caucasica</i> J. F.	2	P	G	R	Vertical	20-40	x				Black-Lilac
<i>Tulipa montanum</i> Lindl.		P	G	-	Vertical	10-20		x			Red
ORCHIDACEAE											
<i>Dactylorhiza osmanica</i> (Kl.)	8-9	P	G	nt	Vertical	15-30		x	x		Red
GRAMINEAE											
<i>Festuca brunnescens</i> (Tzvelev) Galushko	2-7-8	P	H	-	Spherical	20-50		x	x		
<i>Festuca woronowii</i> Heckel.	4-7-8	P	H	R							
<i>Juncus alpigenus</i> C. Koch.	3	P	G	-							

Discussion

The Palandoken mountains have a diversity of plant species which can be assessed in relation to not only their aesthetic properties but also their functional properties. The results obtained from the study were in compliance with those obtained by Guclu (1988) in Erzurum and Koç (1977) in Bursa. Intensive winter and other tourism activities create pressure on alpine flora in highlands (Meyer, 1993; Cole and Trull, 1992). Hence, studies on alpine and rock plants in Turkey, are of important for determination, conservation, culture and environmental education.

Therefore, the following list of plant species were also suggested by Richardson (1970), Harper (1977), Foster (1978), Loewer (1984), Guclu (1988), Brickell (1992) and Walker *et al.* (1994) on materials which can be used in rock and dry wall gardens: *Acantholimon glumaceum*, *Aethionema pulchellum*, *Ajuga pyramidalis*, *A. reptans*, *Allium cyaneum*, *A. karataviense*, *Alyssum montanum*, *A. saxatile*, *Anchusa caespitosa*, *Androsace lanuginosa*, *A. pyrenaica*, *A. sarmentosa*, *A. sempervivoides*, *Anemone hupehensis*, *A. magellanica*, *A. narciflora*, *Arabis albida*, *Arenaria gypsophiloides*, *A. montana*, *A. purpurascens*, *Artemisia schmidtii nana*, *Aster alpinus*, *A. spectabilis*, *Calluna vulgaris*, *Caltha palustris*, *Campamula cochlearifolia*, *C. garganica*, *C. muralis*, *C. piperi*, *C. portenschlagiana*, *C. poscharskyana*, *C. raineri*, *C. tridentata*, *C. zoyssii*, *Clematis alpina*, *Colchicum autumnale*, *C. autumnale album*, *C. nivale*, *C. speciosum*, *C. speciosum album*, *Cotoneaster horizontalis*, *Crocus chrysanthus*, *C. byzantinus*, *C. sativus*, *C. speciosus*, *Cyclamen europaeum*, *C. coum*, *C. neapolitanum*, *Dianthus alpinus*, *D. anatolicus*, *D. carthusianorum*, *D. deltoides*, *D. echinacea*, *D. floribundus*, *D. freynii*, *D. glacialis*, *D. gratianopolitan*, *Draba aizoon*, *D. bryoides*, *D. dedeana*, *D. mollissima*, *D. polytricha*, *D. stellata*, *Erica carnea*, *Erigeron karvinskianus*, *Erinus alpinus*, *Erodium chamaedyroides*, *E. guttatum*, *Euphorbia myrsinites*, *Festuca glauca*, *F. ovina*, *Fritillaria armena*, *Gentiana acaulis*, *G. andrewsi*, *G. crinita*, *G. farreri*, *G. puberula*, *G. porphyrio*, *G. saxosa*, *G. scabra*, *G. sino-ornata*, *G. veitchiorum*, *G. verna*, *Geranium dalmaticum*, *Gypsophila aretioides*, *G. repens*, *G. verna*, *Hepatica acutiloba*, *H. americana*, *Helianthemum nummularium*, *Helicrysum coralloides*, *H. plicatum*, *Iris caucasica*, *I. cristata*, *I. verna*, *Juncus effusus*, *Juniperus squamata*, *Lamium maculatum*, *Mertensia virginica*, *Muscari comosum*, *Narcissus spp.*, *Onosma albo-roseum*, *O. echinoides*, *O. taurica*, *Papaver alpinum*, *P. burseri*, *P. miyabeana*, *P. rhaeticum*, *Phlox divaricata*, *P. stolonifera*, *Polygonum affine*, *Potentilla nitida*, *P. robbinsiana*, *P. rupestris*, *P. tridentata*, *P. verna*, *Primula auricula*, *P. boothii*, *P. edgeworthii*, *P. farinosa*, *P. gracilipes*, *P. marginata*, *P. sochifolia*, *Ranunculus septentrionalis*, *Rumex acetosella*, *Salvia azurea*

grandiflora, *S. pitcheri*, *Sanguinaria canadensis*, *Saponaria ocymoides*, *Saxifraga aizoon*, *S. callosa*, *S. cochlearis*, *S. cotyledon*, *S. longifolia*, *S. paniculata*, *S. virginensis*, *Scilla bifolia*, *Sedum acre*, *S. atratum*, *S. cauticola*, *S. sieboldi*, *S. ternatum*, *Sempervivum spp*, *Senecio aureus*, *Silene acaulis*, *S. schafta*, *S. vulgaris*, *Sternbergia lutea*, *Teucrium chamaedrys*, *Thalictrum dioicum*, *Thymus caespititius*, *T. membranacens*, *T. serpyllum*, *Trillium erectum*, *Tulipa montana*, *Xeranthemum annuum*, *Vaccinium vitis-idea*, *V. oxycoccus*, *Valeriana pauciflora*, *Veronica pectinata*, *V. rupestris*, *V. spicata*, *Viola cazorlensis* and *V. cornuta*

In conclusion, the area surveyed had a highly potential of native plant species for use in rock and dry wall gardens. In order to make use of these plant species for different environmental arrangements, the practical propagation methods of these plants should be determined and put to practice.

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