

Conservation status of five endemic species distributed in Northwest Turkey

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Abstract: This study presents the distribution and conservation status of the following endemic species for Northwest Turkey, mainly for Mt Uludağ: *Arabis drabiformis*, *Aubrieta olympica*, *Gypsophila olympica*, *Achillea multifida*, and *Lamium veronicifolium*. New threat categories for these species are proposed according to the IUCN Red List Criteria. Taxonomic notes and habitat preferences of these endemic plants are given, and environmental impacts on their habitats and population sizes are described.

Key words: conservation, distribution, endemism, flora of Turkey, threatened plants

Introduction

Turkey is one of the most important centres of plant diversity in the temperate zone of the world. Mt Uludağ, one of the major local areas of Turkey for endemism, has many endemic and rare taxa, as well as globally threatened plant species. As a result of our floristic studies, 1309 taxa of 488 genera belonging to 102 families were identified in the area. One hundred sixty-nine of these taxa are endemic to Turkey and the endemism rate is 12.9%. Thirty-one taxa are also known only from Mt Uludağ (Daşkın & Kaynak 2010a,b).

Assessment of the conservation status of Turkish endemic plants, especially of the local ones, is important, in order to prevent their extinction. Since 1985, classification studies of the Turkish endemic plants have been conducted. Their latest classification and their threat categories are given in *The Red Data Book of Turkey* (Ekim & al. 2000). Many studies for re-evaluation of the conservation status of some species at regional, national and international level according to the IUCN (2001) criteria, have been con-

ducted (Uzunhisarcıklı & Vural 2009, Zlatković & al. 2009, Bancheva & Gorgorov 2010, Celep & al. 2010, Şenol & Yıldırım 2010, Yılmaz & al. 2011). Although Daşkın & al. (2004), Daşkın & Kaynak (2005) have examined the population status of the endemic taxa to Mt Uludağ and their threat categories according to Ekim & al. (2000), no re-evaluation of their conservation status according to the IUCN (2001) or IUCN (2010) has been made. This study is aimed to examine the distribution patterns of five narrowly endemic species and to evaluate their threat categories according to the IUCN (2010) Version 8.1.

Material and methods

The materials in this study consist of five endemic species to the study area. Flowering and fruiting specimens of them were collected between 2001 and 2006. During field studies, digital photographs were taken of the species, and their area of occupancy, distribution areas, population size, and status of their habitats were investigated. *Flora of Turkey*, volumes

1, 2, 5, 7 (Cullen 1965a,b; Huber-Morath 1967, 1975; Mill 1982) and the collected specimens were used for the description of the species. The specimens are presented in Table 1. All are numbered and stored at the Herbarium of the Uludağ University, Department of Biology (BULU).

Distribution of these species on Mt Uludağ is shown in Fig. 1. Estimation of their threatened status follows the *IUCN Red List Categories and Criteria* (2010). Furthermore, their earlier and recommended threat categories and threat factors for their habitats and populations are summarized in Table 2.

Table 1. Voucher specimens of the studied taxa.

Taxon	Locality	Herbarium number
<i>Arabis drabiformis</i>	A2 Bursa: Uludag; Aras Valley, rocky slopes, 1800 m, 06.06.2002, G. Kaynak, R. Daşkın, Ö. Yılmaz	BULU 14094
	Uludağ National Park (UNP) lower parts of Rasatdüzü, rocky slopes, 2100 m, 29.07.2004, R. Daşkın, Ö. Yılmaz, E. Erdoğan	BULU 20523
	UNP, Rasatdüzü to Lakes District, alpine stony slopes, 2200–2240 m, 08.07.2006, R. Daşkın, E. Erdoğan	BULU 27963B
	UNP, Lakes District, alpine rocky slopes, 2307 m, 08.08.2006, G. Kaynak, R. Daşkın	BULU 28361
<i>Aubrieta olympica</i>	A2 Bursa: Uludag; Aras Valley, rocky slopes, 1400–1600 m, 06.06.2002, G. Kaynak, R. Daşkın, Ö. Yılmaz	BULU 14086
	Keles road, Sogukpınar Karaislah road fork to Sogukpınar, 1. km, stony slopes, 890 m, 27.05.2003, G. Kaynak, R. Daşkın, Ö. Yılmaz	BULU 15362
	Keles, above Bozova Plateau, alpine rocky slopes, 2120 m, 09.07.2003, G. Kaynak, R. Daşkın, Ö. Yılmaz	BULU 17545
	Above Kirazlı Village, Karakaya Locality, rocky slopes, 900 m, 21.07.2003, G. Kaynak, R. Daşkın, Ö. Yılmaz	BULU 17675
	UNP, around Kuşaklıkaya, alpine rocks, 2068 m, 01.07.2004, G. Kaynak, R. Daşkın, Ö. Yılmaz, E. Erdoğan	BULU 20030
	North slopes of Uludag, above Temenyeri, rocky slopes, 200 m, 26.03.2003, R. (Günay) Daşkın	BULU 14700
	North slopes of Uludag, bed of Kaplıkaya Stream, on rocks, 250 m, 17.05.1984, B. Tözün, A. Çırpıcı	BULU 20
	North slopes of Uludag, above Piremir, on slopes, 250 m, 24.04.1985, B. Tözün, A. Çırpıcı & al.	BULU 210
B2 Bursa: Uludag; Keles, Sorgun Tunçbilek road fork to Sorgun, 6. km, rocky slopes, 950 m, 17.04.2003, G. Kaynak, R. Daşkın, Ö. Yılmaz	BULU 14770	
<i>Gypsophila olympica</i>	A2 Bursa: Uludag; UNP, around Kuşaklıkaya, on calcerous rocks, 2200 m, 19.07.2001, R. (Günay) Daşkın	BULU 13323
	UNP, around Kuşaklıkaya, among <i>Juniperus communis</i> communities, rock crevices, 2200 m, 07.08.2003, R. Daşkın, Ö. Yılmaz	BULU 17900
<i>Achillea multifida</i>	A2 Bursa: Uludag; UNP, around Fatin Hill, 1900 m, 19.07.2001, R. (Günay) Daşkın	BULU 13292B
	Above Alaçam Village to Lakes District, 6–7. km, wet roadsides, watersides, 1800–1900 m, 18.07.2002, R. Daşkın, Ö. Yılmaz	BULU 14449
	Keles, above Bozova Plateau, alpine stony slopes, 1900 m, 09.07.2003, G. Kaynak, R. Daşkın, Ö. Yılmaz	BULU 17530
	UNP, around Sarıalan, 1610 m, 16.07.2003, R. Daşkın, Ö. Yılmaz	BULU 17606
	UNP, Kırkpınarlar Locality, around Çayırılı Stream, 1750 m, 07.08.2003, R. Daşkın, Ö. Yılmaz	BULU 17958
	İnegöl, above Kiran Plateau, alpine stony slopes, 1950 m, 20.07.2004, G. Kaynak, R. Daşkın, Ö. Yılmaz	BULU 20480
	UNP, around Hotels District, at roadsides, 1900 m, 29.07.2004, R. Daşkın, Ö. Yılmaz, E. Erdoğan	BULU 20611
	UNP, around Tungsten Mine, at roadsides, 08.07.2006, 2000 m, R. Daşkın, E. Erdoğan	BULU 27947
UNP, around Lakes District, alpine meadows, 2278 m, 08.08.2006, G. Kaynak, R. Daşkın	BULU 28332	
<i>Lamium veronicifolium</i>	A2 Bursa: Uludag; UNP, Lakes District, around Kara Lake, on stony and rocky slopes, 2278 m, 08.08.2006, G. Kaynak, R. Daşkın	BULU 28357
	UNP, Lakes District, around Buzlu Lake, on wet rocky slopes, 2307 m, 08.08.2006, G. Kaynak, R. Daşkın	BULU 28374

Table 2. Conservation status of the studied taxa, threat criteria and threat factors for their conservation.

Taxon	Earlier category (Ekim & al. 2000)	Proposed threat category (Daşkın & Kaynak 2011)	Criteria (IUCN 2010)	Threat factors
<i>Arabis drabiformis</i>	VU	EN	B1; B2a, b (i, ii, iii)	I, II
<i>Aubrieta olympica</i>	EN	VU	B2 a, b (iii)	I, II, III
<i>Gypsophila olympica</i>	EN	CR	B1; B2a, b (iii)	I, III
<i>Achillea multifida</i>	EN	VU	B2 a, b (i, ii, iii)	I, II, III
<i>Lamium veronicifolium</i>	VU	CR	B1; B2a, b (i, ii, iii)	II, III

Threat factors: I – construction of hotels and ski lift areas for winter tourism; II – excessive human activities (i.e. picnicking, camping, tracking); III – overgrazing.

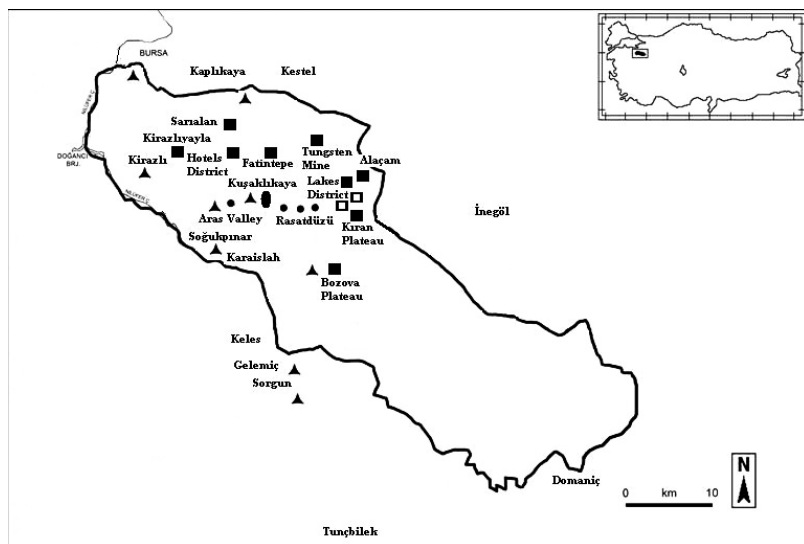


Fig. 1. Distribution of *Arabis drabiformis* (●), *Aubrieta olympica* (▲), *Gypsophila olympica* (◐), *Achillea multifida* (■), and *Lamium veronicifolium* (□) in Mt Uludağ.

Results and discussion

Brassicaceae (Cruciferae)

1. *Arabis drabiformis* Boiss. (Fig. 2).

Type: Olympos, Aucher 100 (G).

Description. Perennial herb with a stout woody stock; stems 7–14 cm, erect, glabrous, unbranched. All leaves in basal rosettes, oblanceolate, 5–7 × 1.5–2 mm, setose-pilose. Sepals saccate, 3 × 1 mm, glabrous, pale-brown, with narrow scarious margins. Petals white, 4–6 × 2–3 mm. Siliquae 18–20 × 2 mm, adpressed-patent, glabrous, the valves with a conspicuous median nerve. Flowering: June–August.

Arabis drabiformis resembles *A. bryoides* Boiss. collected by Aucher from Thessalian Olympos, Greece and described by Boissier. The species is also close to the Turkish taxa *A. carduchorum* and *A.*



Fig. 2. *Arabis drabiformis* Boiss. (photo R. Daşkın).

androsacea, but differs from them by its glabrous and leafless stem (Cullen 1965 a). It grows on ridges, stony and rocky slopes, at altitudes between 1800 m and 2400 m, in the subalpine and alpine regions of Mt Uludag, together with the following plant taxa: *Erodium sibthorpiatum* Boiss. subsp. *sibthorpiatum*, *E. olympicum* Gemici & Leblebici, *Hypericum confertum* Choisy subsp. *confertum*, *Onobrychis montana* DC. subsp. *cadmea* (Boiss.) P.W. Ball, *Asyneuma limonifolium* (L.) Janchen subsp. *limonifolium*, *Minuartia hirsuta* (M. Bieb.) Hand.-Mazz. subsp. *falcata* (Gris.) Mattf., *Veronica multifida* L., *Dianthus leucopheus* Sibth. & Sm. var. *leucopheus*, *Silene falcata* Sibth. & Sm., *Galium olympicum* Boiss., and *Muscari bourgaei* Baker.

Conservation status. During our field studies, it was collected from four localities (Table 1). The extent of occurrence and area of occupancy of this species are less than 5 000 km² and 500 km², respectively. Furthermore, its present populations and habitats are endangered by the construction of ski tracks for winter tourism and partially by such recreational activities as tracking. According to IUCN (2010), the threat category of the species should be changed from Vulnerable (VU) to Endangered [EN B1; B2 ab (i, ii, iii)] (Table 2).

2. *Aubrieta olympica* Boiss. in Fl. Orient. 1: 251 (1867) (Fig. 3)

Syntypes: Turkey. A2 Bursa: in regione alpina summa Olympi Bythiniae, *Clementi* (E); Bursa: Ulu Da., 200 m, *Bornm.* 1899: 408; *ibid.*, 2400 m, *Davis* 14814 (fruits hairy) & *Davis* 14813 (fruits glabrous).



Fig. 3. *Aubrieta olympica* Boiss. (photo R. Daşkın).

Description. Dwarf perennial herbs. Stems up to 20 cm, prostrate, densely covered with stellate hairs. Leaves oblanceolate, 7–30 × 4–10 mm, attenuate to petiole, acute, green, densely stellate hairy, dentate to entire, lower often subopposite. Sepals saccate, ca. 7–8 × 1–1.5 mm, densely stellate hairy, greenish-purplish. Petals 11–19 × 5–6 mm, spatulate, glabrous, violet. Fruits oblong, flattened, 15–18 × 4–5.5 mm, covered sparsely or densely with stellate hairs. Style 4–8 mm. Seeds numerous, ca. 1.5 mm, black, finely tuberculate. Flowering: June–September.

Morphologically, *Aubrieta olympica* resembles strongly *A. canescens*, but differs mainly in its more flattened (15–18 × 4–5.5 mm, not 9–13 × 1.5–3 mm) fruits. Although Davis said that glabrous and hairy-fruited variants of *A. olympica* grow together (Cullen 1965b), we have failed to collect any specimens with glabrous fruit on Mt Uludağ. The species grows on stony and rocky slopes, or occasionally among rocks, at altitudes from 200 m to 2400 m. It was usually found together with other vascular plants, such as *Erysimum smyrnaeum* Boiss. & Balansa, *Draba bruniifolia* Steven subsp. *olympica* (Sibth. ex DC.) Coode & Cullen, *Matthiola montana* Boiss., *Polygala anatolica* Boiss. & Heldr., *Linum oylmpicum* Boiss., *Saxifraga sempervivum* K. Koch, *Campanula lyrata* Lam. subsp. *lyrata*, *Thymus longicaulis* C. Presl subsp. *chaubardii* (Boiss. & Heldr. ex Rchb. f.) Jalas var. *chaubardii*, and *Festuca puntoria* Sibth. & Sm.

Conservation status. At present, *A. olympica* is known from 10 different localities (Table 1), one of them given in an earlier record by Çirpıcı (1989) from Mt Murat (Kütahya province in B2 square). The area of occupancy of this species is under 2 000 km² and

its habitats and populations, at least on Mt Uludağ, are subject to the following threats: excessive construction, human pressure and overgrazing. Thus, the threat category of the species should be changed from Endangered (EN) to Vulnerable [VU B2 ab (iii)], according to IUCN (2010) (Table 2).

Caryophyllaceae

3. *Gypsophila olympica* Boiss. in Diagn. Ser. 1(8): 55 (1849) (Fig. 4)

Type: Turkey. A2 Bursa: ad rupes calcareas regionis alpinae Olympi Bithyni (Ulu Da.), meridiem versus, 1842, *Boissier* (holo. G)

Description. Caespitose perennial with woody rhizome. Stems 3–15(–20) cm, numerous, glabrous, unbranched, tinged with purple. Leaves linear, triquetrous, 5–20 × 0.5–1 mm, acute, scabrid at margins, congested at base. Cauline leaves opposite, connate at base, sheathing and slowly inflated at nodes. Flowers arranged in mostly single, seldom two, terminal 7–10 mm diam. clusters. Bracts ovate, acuminate, glandular-pubescent. Calyx campanulate, 2.5–3.5 mm, densely glandular hairy, scarious and purplish at apex, with shortly acuminate teeth. Petals white to pink, 4–5 mm, cuneate, obtuse. Capsules included in calyx, indehiscent, with 1–4 seeds. Seeds 1–1.5 mm, black, with acute tubercles. Flowering: July–August.

Gypsophila olympica is closely related to *G. pilulifera* and *G. sphaerocephala*. However, it can be distinguished from them by its stem with mostly a solitary flower cluster and its cuneate petal, respectively (Huber-Morath 1967). The species prefers to grow on limestone slopes and among limestone rocks, above



Fig. 4. *Gypsophila olympica* Boiss. A, Habit; B, Inflorescence (photo R. Daşkın).

2000 m a.s.l. on Mt Uludag. It occurs together with the following vascular plants: *Botrychium lunaria* (L.) Sw., *Cerastium banaticum* (Roch.) Heuff., *Paronychia amani* Chaudhri, *Onobrychis montana* subsp. *cadmea*, *Olymposciadium olympicum* (Sm.) Wolff, *Ferulago macrosciadia* Boiss. & Balansa, *Anthemis cretica* L. subsp. *carpatica* (Willd.) Grierson, *Centaurea drabifolia* Sibth. & Sm. subsp. *drabifolia*, and *Galium olympicum*.

Conservation status. According to our present knowledge, *G. olympica* is known only from a single locality in Turkey (Mt Uludag, Kuşaklıkaya and its surroundings, Fig. 1) and is represented by about 1000 individuals. Furthermore, its extent of occurrence is less than 100 km²; area of occupancy is less than 10 km² and its habitats are subject to construction of ski runs and ski tracks and partial overgrazing. Therefore, the threat category of the species should be changed from Endangered (EN) to Critically Endangered [CR B1; B2 ab (iii)], according to IUCN (2010) (Table 2).

Asteraceae (Compositae)

4. *Achillea multifida* (DC.) Boiss. (Fig. 5).

Syn. *Ptarmica multifida* DC. in Prodr. 7: 295 (1838); *Achillea atrata* L. subsp. *multifida* (DC.) Heimerl in Denkschr. Akad. Wiss. Wien, Math.-Nat. Kl. 48: 140 (1884).

Type: Turkey A2(A) Bursa; Olympus Bithynus (Ulu Da.), Aucher 1837: 3296 (holo. G)

Description. Perennial herb with 10–30 cm high stems. Leaves green, with indumentum of loose spreading hairs. Basal leaves 2–3-pinnatifid to pinnatisect, lanceolate-oblong, 2–4 × 0.8–1 cm, primer segments 6–10 pairs, ultimate lobes linear, 1–3 × 0.2–0.7 mm, subacute. Median cauline leaves 2–4 ×



Fig. 5. *Achillea multifida* (DC.) Boiss. (photo R. Daşkın).

0.8–1.5 cm. Capitula 3–20 in 2–6 cm broad corymbs. Peduncles 2–15 mm. Involucre hemispherical to depressed, 3.5–4 × 4–6 mm. Phyllaries loosely spreading hairy. Outer phyllaries lanceolate, subacute, 1–1.5 mm. Inner phyllaries broadly obovate, obtuse, 3–3.5 mm, with brownish scarious, lacerate 0.3–0.5 mm margins. Ligules 6–9, white, 3–4 mm, oblong-ovate. Disc flowers ca. 40–50, yellow, 5-toothed, 2–2.5 mm, bases pouched and enveloping the tops of achenes. Paleae oblong-obovate, hyaline, with brownish scarious, lacerate margins like phyllaries. Achenes ca. 2 mm, obovate, glabrous, smooth, unwinged, compressed. Pappus absent. 2n = 18, Flowering: July–September.

Achillea multifida belongs to section *Ptarmica* (DC.) W. Koch. and can be distinguished from other members of this section in Turkey (*A. biserrata* Bieb. and *A. fraasii* Schultz Bip. var. *troiana* Aschers. & Heimerl) by pinnatifid to pinnatisect green leaves and leaves with loose spreading hairs, respectively. On the other hand, *A. multifida* is close to *A. clusiana* Tausch from E. Alps and mountains of the Balkan Peninsula, but differs from it mainly in shorter, subacute, not acuminate ultimate leaf segments (Huber-Morath 1975). *A. multifida* has broad-ranging ecological preferences; it inhabits exposed roadsides, streamsides and open places or edges in the *Abies nordmanniana* Spach subsp. *bornmulleriana* (Matff.) Coode & Cullen (Uludag fir) forests, subalpine meadows, among *Juniperus communis* L. var. *saxatilis* Pall. (Dwarf Juniper) communities, and alpine stony or rocky slopes. It occurs with the vascular plants: *Arabis drabiformis*, *Rumex olympicus* Boiss., *Silene olympica* Boiss., *Potentilla buccoana* Clem., *Asyneuma limonifolium* subsp. *limonifolium*, *Vaccinium myrtillus* L., *Digitalis ferruginea* L. subsp. *ferruginea*, *Veronica gentianoides* Vahl, *Verbascum olympicum* Boiss., *Lamium veronicifolium*, *Orchis mascula* (L.) L. subsp. *pinetorum* (Boiss. & Kotschy) E.G. Camus, and *Festuca paphlagonica* (St.-Yves) Markgr.-Dann. subsp. *paphlagonica*.

Conservation status. The area of occupancy of the species was less than 2 000 km² and it was collected from nine different localities (Fig. 1, Table 1). The present populations and habitats of the species are strongly subjected to construction of hotels and ski tracks, and human activities, such as picnicking, camping, tracking, and overgrazing. For all these reasons, its threat category should be changed from Endangered (EN) to Vulnerable [VU B2 ab (i, ii, iii)], according to IUCN (2010) (Table 2).

Lamiaceae (Labiatae)

5. *Lamium veronicifolium* Bentham (Fig. 6)

Type: In Graecia, Sibthorp (OXF)

Description. Procumbent perennial with creeping rootstock. Stems ascending, 8–25 cm, glabrous. Leaves ovate-reniform, 4–16 × 4–14 mm, obtuse, cordate, crenate, blackish-green, minutely puberulent on both surfaces. Petioles 5–20 mm, puberulent. Verticillasters 2, 2-flowered, very congested. Bracteoles 3–4 × 0.5–1 mm, linear-lanceolate, minutely puberulent and glandular hairy on margins. Calyx obliquely campanulate, 11–14 mm; tube erect, 7–10 mm, glabrous; teeth triangular, 2–4 mm, acuminate, 1-veined, puberulent and stalked glandular hairy on margins and veins. Corolla rose or mauve-pink, 40–41 mm, densely long white hairy on the outside, especially on the upper lip; tube straight, 26–27 mm, dark purple-striated, annulus absent; upper lip 13–15 mm, 3–4-denticulate or deeply retuse to 1.5–2 mm; lower lip crenate, 6–11 mm; middle lobe deeply retuse, with a few purple blotches and purple lines. Nutlets 3 × 1.4–1.6 mm, blackish-green, with a few points. Flowering: July-September.

L. veronicifolium is allied to *L. microphyllum* and *L. garganicum*, but it differs from them mainly by its straight corollas (uncurved), and procumbent, creeping stems (not erect or sprawling), as well as 2-flowered verticillasters (not 4–8(–12)-flowered), respectively (Mill 1982). The species grows on wet stony and rocky slopes in the alpine regions of Mt Uludağ (between 2200 m and 2400 m a.s.l.), together with the following other endemic vascular plants: *Arabis drabiformis*, *Hypericum adenotrichum* Spach, *Astragalus sibthorpianus* Boiss., *Achillea multifida*, *Doronicum bithynicum* J.R. Edm. subsp. *bithynicum*, *Jasione supina* Sieber subsp. *supina*, *Allium flavum* L. subsp. *flavum* var. *minus* Boiss., and *Festuca punctoria*.

Conservation status. According to our present knowledge, *L. veronicifolium* is known only from two localities in the Lakes District (around Kara and Buzlu Lakes, Fig. 1, Table 1). The distance between these localities is less than 2 km. Extent of occurrence of the species and its area of occupancy are less than 100 km² and 10 km², respectively. Furthermore, the areas with the populations of the species are under human pressure and overgrazing. For these reasons, its conservation status should be estimated as Critically Endangered [CR B1; B2 ab (i, ii, iii)] according to IUCN (2010) Version 8.1 (Table 2).

Conclusions

Five species endemic to Turkey are presented here: *Arabis drabiformis*, *Aubrieta olympica*, *Gypsophila olympica*, *Achillea multifida*, and *Lamium veronicifolium*. They all, except for *A. olympica*, are known only from Mt Uludağ. When the distribution patterns of these species were examined in the mountain, *A. drabiformis*, *G. olympica*, *A. multifida*, and *L. veronicifolium* were occurring only in the northern part of the area. The extended area of *A. olympica* however was wider than those of the others and it has spread both to the north and south of Mt Uludağ. The distribution areas of *G. olympica*



Fig. 6. *Lamium veronicifolium* Bentham (photo G. Kaynak).

and *L. veronicifolium* were very limited and concentrated around Kuşaklıkaya and the Lakes District within the Uludağ National Park, UNP (Fig. 1). On the other hand, *Arabis drabiformis* and *Achillea multifida* were close to some species from the Balkan Peninsula mountains. This observation supports strongly a connection between the floras of Turkey and the Balkan Peninsula as a result of floristic interactions during the Ice Age.

Mt Uludağ has rich plant diversity and one of the major winter sports centres in Turkey. The Sarıalan, Kirazlıyayla, Hotels District, Fatin Hill, Kuşaklıkaya, Rasatdüzü, Tungsten Mine, and Lakes District have been used both for winter sports and recreational activities in summer. Soğukpınar, Aras Valley, Bozova Plateau, Kiran Plateau, and Alaçam have been partially subjected to overgrazing. The results obtained from this study have shown that the plants, especially *G. olympica* and *L. veronicifolium* placed in CR category, are endangered by environmental impacts: excessive construction for winter tourism (i. e. building hotels, ski tracks and ski lifts), excessive human pressure (i. e. picnicking, camping, tracking) and overgrazing.

Some *in situ* and *ex situ* conservation action must be undertaken for these species. For *in situ* conservation, the owners of the hotels and visitors must be made familiar with these plants in meetings, brochures or books, thus arousing general awareness of the floristic diversity of Mt Uludağ (Kaynak & al. 2008). For *ex situ* conservation, studies into the related conservation of genetic resources of the endemic plants grown in the area by biotechnological methods (i. e. micropropagation, *in vitro* conservation) should be carried out. In this context, our project on conservation of certain local endemic plants in Mt Uludağ by classical and biotechnological methods, was recently accepted and supported by the Ministry of Agriculture of the Republic of Turkey. With this project (TAGEM-11/AR-GE/14), a gene bank, including vegetative parts and seeds of these plants, can be established.

References

- Bancheva, S. & Gorgorov, R. 2010. Taxonomic revision and conservation status of *Centaurea davidovii* (sect. *Leptanthus*, Asteraceae). – Phytol. Balcan., **16**(2): 255-261.
- Celep, F., Doğan, M. & Kahraman, A. 2010. Re-evaluated conservation status of *Salvia* (sage) in Turkey I: The Mediterranean and the Aegean geographic regions. – Turk. J. Bot., **34**: 201-214.
- Çırpıcı, A. 1989. Flora of Mount Murat (Kütahya-Uşak, Turkey). – Doğa Türk Bot. Derg., **13**(2): 157-222 (in Turkish).
- Cullen, J. 1965a. *Arabis* L. – In: Davis, P.H. (ed.), Flora of Turkey and the East Aegean Islands. Vol. 1, pp. 424-425. Edinburgh Univ. Press, Edinburgh.
- Cullen, J. 1965b. *Aubrieta* Adans. – In: Davis, P.H. (ed.), Flora of Turkey and the East Aegean Islands. Vol. 1, pp. 444-447. Edinburgh Univ. Press, Edinburgh.
- Daşkın, R., Yılmaz, Ö. & Kaynak, G. 2004. Threat Categories of Endemic Plants for Uludağ Mt. – In: Proc. Fifth National Ecology and Environment Congress. October 5-8, 2004, Bolu. Pp. 57 (in Turkish).
- Daşkın, R. & Kaynak, G. 2005. The Present Population Status of the Endemic Plants for Uludağ Mt. – In: Proc. First Bursa Tourism Symp. September 30-October 2, 2005, Bursa. Pp. 232-241 (in Turkish).
- Daşkın, R. & Kaynak, G. 2010a. Vascular flora of the Uludağ Mt (Bursa, Turkey) – I. – Phytol. Balcan., **16** (3): 367-384.
- Daşkın, R. & Kaynak, G. 2010b. Vascular flora of the Uludağ Mt (Bursa, Turkey) – II. – Phytol. Balcan., **16**(3): 385-411.
- Ekim, T., Koyuncu, M., Vural, M., Duman, H., Aytaç, Z. & Adıgüzel, N. (eds). 2000. The Red Book of Turkish Plants (*Pteridophyta* and *Spermatophyta*). Turkish Association for the Conservation of Nature – Van Centennial Univ., Barışcan Ofset, Ankara (in Turkish).
- Huber-Morath, A. 1967. *Gypsophila* L. – In: Davis, P.H. (ed.), Flora of Turkey and the East Aegean Islands. Vol. 2, pp. 156. Edinburgh Univ. Press, Edinburgh.
- Huber-Morath, A. 1975. *Achillea* L. – In: Davis, P.H. (ed.), Flora of Turkey and the East Aegean Islands. Vol. 5, pp. 228-229. Edinburgh Univ. Press, Edinburgh.
- IUCN. 2001. IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission. Gland, Switzerland and Cambridge, UK.
- IUCN. 2010. Guidelines for Using the IUCN Red List Categories and Criteria: Version 8.1. Standards and Petitions Subcommittee of the IUCN Species Survival Commission.
- Kaynak, G., Daşkın, R. & Yılmaz, Ö. (eds). 2008. The Plants of Bursa, 2nd ed. Uludağ Univ. Press, Publ. No: 08-029-0476, Bursa (in Turkish).
- Mill, R.R. 1982. *Lamium* L. – In: Davis, P.H. (ed.), Flora of Turkey and the East Aegean Islands. Vol. 7, pp. 126-148. Edinburgh Univ. Press, Edinburgh.
- Şenol, S.G. & Yıldırım, H. 2010. A new distribution area of *Asperula daphneola* (Rubiaceae) in Western Turkey and its new recommended IUCN threat category. – BioDiCon., **3**(2): 123-127 (in Turkish).
- Uzunhisarcıklı, M.E. & Vural, M. 2009. Taxonomy and IUCN categories of two *Alcea* L. (*Malvaceae*) species cited in the Data Deficient (DD) category. – BioDiCon., **2**(2): 90-95 (in Turkish).
- Yılmaz, Ö., Daşkın, R. & Kaynak, G. 2011. IUCN categories of three *Linum* L. (*Linaceae*) taxa endemic to Turkey. – BioDiCon., **4**(1): 133-138 (in Turkish).
- Zlatković, B., Tomović, G., Randelović, V., Vukojičić, S. & Niketić, M. 2009. Distribution and conservation status of several new and neglected vascular plants in Serbia. – Phytol. Balcan., **15**(1): 95-105.

