

## EVALUATION OF THREAT CATEGORIES OF THE ENDEMIC PLANTS OF DEVECİ MOUNTAINS (YOZGAT-TOKAT/TURKEY)

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**ABSTRACT.** This study based on the vegetation field survey between April 1993 and October 1997 is done for the purpose of determining the vegetation of Deveci Mountains (Yozgat-Tokat). During the plant vegetation seasons, 1400 plant samples were collected from the research area. 456 taxa and 262 genera to be belonging to 63 families were determined. In the survey area, five different vegetation types coniferous and deciduous forest, scrub, steppe, rocky and wet grassland were present. The threat categories of the endemic species of Deveci Mountains were determined and evaluated according to 'Red Data Book of Turkish Plants', which was prepared by using IUCN criteria. A total of 65 plant taxa were determined as endemic (14.25% of all taxa). Highest ratios of endemic taxa were from families *Fabaceae* (16.92%) and *Lamiaceae* (16.92%). Phytogeographic regions (Chorotypes) among endemic taxa were listed as Irano-Turanian 35 (53.85%), Eastern Mediterranean 3 (4.62%), Euxine 2 (3.08%), Euro-Siberian 1 (1.54%), while phytogeographic origin of (24 taxa) 36.92% of endemic taxa were Unknown. As endemic taxa and their threat categories are evaluated, 1 (1.54%) species was found to in Endangered, 4 (6.15%) in Vulnerable, 7 (10.77%) in Near Threatened and 53 (81.54%) in Least Concern according to IUCN criteria. When the plant taxa were classified and analysed according to Raunkiaer's life forms, Hemicryptophytes were determined to be the most common plant taxa (76.92%), Chamaephytes come next (9.23%), is followed by the Therophytes (7.69%), and then come Phanerophytes (4.62%). While Geophytes have the least number of plant taxa with 1 species (1.54%).

### 1. INTRODUCTION

Turkey is one of the plant diversity rich countries due to its different ecological, climatic and topographical conditions. There are more than 12000 plant taxa in Turkey, which naturally occur and approximately one third of those taxa are endemic [1, 2]. Factors leading to the emergence of that high number have been investigated for many years. Those researches are especially important for determining the current situation of the endangered species and for taking necessary protective measures.

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In order to conserve the integrity and diversity of nature, IUCN (International Union for Conservation of Nature) [3] was founded in 1948. This membership union periodically updates “Red List of Threatened Categories” that uses a set of concrete criteria to determine the extinction risk of plant and animal species in the world. Based on those criteria (version 2.3 [4] in 2000 [1]) and “List of Rare, Threatened and Endemic Plants in Turkey” prepared by TTKD (The association for conservation of the nature of Turkey) [5] were utilized in this study to evaluate the risk categories of the endemic plants of Deveci Mountains.

The study area located between 40°-41° latitudes and 35°-36° longitudes is in the transitional zone between Central and Northern Anatolia. Deveci Mountains is a mountain chain which extend from east of Çekerek district NE Yozgat towards Artova district SW Tokat, fitting in A5, A6 and B5 square according to grid system of Davis. Different types of habitats can be found within the altitude range varying between 500 and 1907 (Figure 1).

The climatic data obtained from the Yozgat and Tokat meteorological stations were analyzed, interpreted and summarized by taking into account the studies of Akman and Dağet [6]. The nature of the vegetation and vegetation of the research area shows that the region is under the influence of the Mediterranean climate. Two types of Precipitation Regime are seen in the meteorological stations in the research area. In Tokat; the seasonal precipitation regime is (SAWS) Spring, Autumn, Winter, Summer which indicates “Semiarid Upper Cold Mediterranean Climate of Sub-Mediterranean Precipitation Regime”, also in Yozgat; the seasonal precipitation regime is (SWAS) Spring, Winter, Autumn, Summer which indicates “Very Cold Mediterranean Climate with Less Precipitation of Second Type of East Mediterranean Precipitation Regime” according to Emberger [6, 7]. Research area is floristically belongs to the Irano-Turanian phytogeographical region and has mainly steppe vegetation besides coniferous and deciduous forest, scrub, rocky and wet grassland vegetations. The vegetation in the study area is intensely affected by overgrazing, agricultural activities and expansion of stone and marble quarries. There has not been any conservation of the area so far.

The flora of study area was previously investigated by Ilarslan and 70 endemic species were determined by him [8, 9]. These species except 35 species shared with the present list, were not included in our study. In this study threat categories which apply to endemic plant species found in Deveci Mountains (Yozgat-Tokat/Turkey)

were determined and their assessments were made. Similar studies by different researchers in different parts of Turkey were made [10-23].

## 2. MATERIAL AND METHODS

Plant specimens were collected between 1993 and 1997 during different vegetative period. Collected samples to endemic plants were transferred to herbarium according to standard methods. Identifications were made according to flora studies [2, 24-28] and plant samples in Herbarium of Biology Department, Faculty of Science, Ankara University (ANK) in which the collected plant samples also was deposited and saved.

Order of the list of endemic taxa is based on phylogenetical system applied in Flora of Turkey in determination of threat categories, "IUCN Red List Categories: version 3.1" [29, 30] and Red Data Book of Turkish Plants" were used [1]. Along with the threat categories, phytogeographical regions [31, 32] and life forms (according to Raunkiaer) of endemic plant taxa were also included [33].

## 3. RESULTS

Totally 65 endemic taxa related to 20 families at species, subspecies or variety levels occur in Deveci Mountains. In Table 1, distributions of endemic taxa into families were given in the descending order, while distribution of endemic plant taxa according to phytogeographical regions and their percentages were given in Table 2 in the same order. A list of endemic taxa determined from Deveci Mountains according to phylogenetical order together with their phytogeographical regions, life forms and threat categories were also given in Table 3.

TABLE 1. The distribution of endemic plant taxa into families.

	Families	Number of Endemic Taxa	Percentage (%)
1	FABACEAE	11	16.92
2	LAMIACEAE	11	16.92
3	CARYOPHYLLACEAE	6	9.23
4	APIACEAE	5	7.69

5	PLANTAGINACEAE	5	7.69
6	ASTERACEAE	4	6.15
7	BRASSICACEAE	4	6.15
8	BORAGINACEAE	4	6.15
9	POACEAE	2	3.08
10	RUBIACEAE	2	3.08
11	RUTACEAE	2	3.08
12	SCROPHULARIACEAE	1	1.54
13	CAMPANULACEAE	1	1.54
14	CAPRIFOLIACEAE	1	1.54
15	CONVOLVULACEAE	1	1.54
16	FAGACEAE	1	1.54
17	HYPERICACEAE	1	1.54
18	IRIDACEAE	1	1.54
19	RANUNCULACEAE	1	1.54
20	ROSACEAE	1	1.54
	Total	65	100

TABLE 2. The distribution of endemic plant taxa according to phytogeographical regions/elements (chorotypes) [31, 32].

	Phytogeographical Regions	Number of Endemic Taxa	Percentage (%)
1	Irano-Turanian (IT)	35	53.85
2	Eastern Mediterranean (EM)	3	4.62
3	Euxine (Eux)	2	3.08
4	Euro-Siberian (ES)	1	1.54
5	Unknown (U)	24	36.92
	Total	65	100

TABLE 3. Threat categories, phytogeographical regions/elements (chorotypes) and life forms of endemic plant taxa [29, 30].

	Families	Endemic Taxon	Chorotype	Life Form	Threat Category
1	RANUNCULACEAE	<i>Delphinium dasystachyum</i> Boiss. et Bal.	IT	Th	LC
2	BRASSICACEAE	<i>Alyssum pateri</i> Nyar. subsp. <i>pateri</i>	IT	H	LC
3	BRASSICACEAE	<i>Alyssum pseudo-mouradicum</i> Hausskn. et Bornm. ex Baumg.	U	H	LC
4	BRASSICACEAE	<i>Erysimum thyrsoideum</i> Boiss. subsp. <i>ponticum</i> (Hausskn. et Bornm.) Cullen	U	H	LC
5	BRASSICACEAE	<i>Erysimum thyrsoideum</i> Boiss. subsp. <i>thyrsoideum</i>	U	H	LC
6	CARYOPHYLLACEAE	<i>Arenaria ledebouriana</i> Fenzl var. <i>ledebouriana</i>	U	Th	LC
7	CARYOPHYLLACEAE	<i>Dianthus carmelitarum</i> Reut. ex Boiss.	Eux	H	LC
8	CARYOPHYLLACEAE	<i>Dianthus lydus</i> Boiss.	U	H	LC
9	CARYOPHYLLACEAE	<i>Minuartia corymbulosa</i> (Boiss. et Bal.) McNeill var. <i>corymbulosa</i>	IT	H	NT
10	CARYOPHYLLACEAE	<i>Minuartia gracilis</i> McNeill	U	H	VU
11	CARYOPHYLLACEAE	<i>Saponaria prostrata</i> Willd. subsp. <i>prostrata</i>	IT	Th	LC
12	HYPERICACEAE	<i>Hypericum lanuginosum</i> Lam. var. <i>pestalozzae</i> (Boiss.) Robson	EM	H	VU
13	RUTACEAE	<i>Haplophyllum armenum</i> Spach	U	H	LC
14	RUTACEAE	<i>Haplophyllum telephioides</i> Boiss.	IT	H	NT

15	FABACEAE	<i>Astragalus lycius</i> Boiss.	U	Ch	LC
16	FABACEAE	<i>Astragalus noeanus</i> Boiss.	IT	Ch	LC
17	FABACEAE	<i>Astragalus sigmoideus</i> Bunge	U	Ch	LC
18	FABACEAE	<i>Astragalus stenosemius</i> Boiss. et Noë	IT	Ch	LC
19	FABACEAE	<i>Lathyrus czechottianus</i> Bäsler	U	H	LC
20	FABACEAE	<i>Lotus gebelia</i> Vent. var. <i>anthylloides</i> Boiss.	IT	H	NT
21	FABACEAE	<i>Onobrychis argyrea</i> Boiss. subsp. <i>argyrea</i>	IT	H	LC
22	FABACEAE	<i>Onobrychis armena</i> Boiss. et Huet	IT	H	LC
23	FABACEAE	<i>Onobrychis bornmuelleri</i> Freyn	U	H	EN
24	FABACEAE	<i>Trifolium caudatum</i> Boiss.	U	H	LC
25	FABACEAE	<i>Trifolium pannonicum</i> Jacq. subsp. <i>elongatum</i> (Willd.) Zoh.	U	H	LC
26	ROSACEAE	<i>Crataegus tanacetifolia</i> (Lam.) Pers.	U	Ph	LC
27	APIACEAE	<i>Bupleurum sulphureum</i> Boiss. et Bal.	IT	Th	LC
28	APIACEAE	<i>Heracleum platytaenium</i> Boiss.	Eux	H	LC
29	APIACEAE	<i>Malabaila pastinacifolia</i> Boiss et Bal.	IT	H	LC
30	APIACEAE	<i>Pimpinella anisetum</i> Boiss. et Bal.	IT	H	NT
31	APIACEAE	<i>Pimpinella cappadocica</i> Boiss. et Bal. var. <i>cappadocica</i>	IT	H	LC
32	CAPRIFOLIACEAE	<i>Lonicera caucasica</i> Pallas subsp. <i>orientalis</i> Chamb. et Long	U	Ph	LC
33	ASTERACEAE	<i>Centaurea drabifolia</i> Sm. subsp. <i>detonsa</i> (Bornm.) Wagenitz	U	H	LC
34	ASTERACEAE	<i>Centaurea urvilleii</i> D.C. subsp. <i>stepposa</i> Wagenitz	U	H	LC
35	ASTERACEAE	<i>Hieracium bornmuelleri</i> Freyn.	U	H	LC

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36	ASTERACEAE	<i>Scorzonera tomentosa</i> L.	IT	H	LC
37	CAMPANULACEAE	<i>Asyneuma limonifolium</i> (L.) Janchen subsp. <i>pestalozzae</i> (Boiss.) Damboldt	U	H	LC
38	CONVOLVULACEAE	<i>Convolvulus assyricus</i> Griseb.	IT	Ch	LC
39	BORAGINACEAE	<i>Nonea macrosperma</i> Boiss. et Heldr.	IT	H	LC
40	BORAGINACEAE	<i>Onosma armenum</i> DC.	U	H	LC
41	BORAGINACEAE	<i>Onosma bornmuelleri</i> Hauskn.	IT	H	LC
42	BORAGINACEAE	<i>Onosma sieheanum</i> Hayek	IT	H	VU
43	SCROPHULARIACEAE	<i>Verbascum melitenense</i> Hub.-Mor.	IT	H	NT
44	LAMIACEAE	<i>Ballota nigra</i> L. subsp. <i>anatolica</i> P.H. Davis	IT	H	LC
45	LAMIACEAE	<i>Marrubium globosum</i> Montbret et Aucher ex Bentham subsp. <i>globosum</i>	IT	H	LC
46	LAMIACEAE	<i>Phlomis armeniaca</i> Willd.	IT	H	LC
47	LAMIACEAE	<i>Salvia blepharochlaena</i> Hedge et Hub.- Mor.	IT	H	NT
48	LAMIACEAE	<i>Salvia cryptantha</i> Montbret et Aucher ex Bentham	IT	H	LC
49	LAMIACEAE	<i>Salvia hypargeia</i> Fisch. et Mey.	IT	H	LC
50	LAMIACEAE	<i>Satureja wiedemanniana</i> (Lallem.) Velen.	U	H	LC
51	LAMIACEAE	<i>Scutellaria salviifolia</i> Bentham	U	H	LC
52	LAMIACEAE	<i>Stachys cretica</i> L. subsp. <i>anatolica</i> Rech. fil.	IT	H	LC
53	LAMIACEAE	<i>Stachys cretica</i> L. subsp. <i>mersinaea</i> (Boiss.) Rech. fil.	EM	H	LC
54	LAMIACEAE	<i>Wiedemannia orientalis</i> Fisch. et Mey.	IT	Th	LC
55	PLANTAGINACEAE	<i>Digitalis lamarckii</i> Ivan.	IT	H	LC
56	PLANTAGINACEAE	<i>Linaria corifolia</i> Desf.	IT	H	LC
57	PLANTAGINACEAE	<i>Linaria genistifolia</i> (L.) Miller var. <i>confertiflora</i> (Boiss.) Davis	IT	H	LC

58	PLANTAGINACEAE	<i>Veronica multifida</i> L.	U	Ch	LC
59	PLANTAGINACEAE	<i>Veronica thymoides</i> P.H. Davis subsp. <i>pseudocinerea</i> M.A. Fischer	IT	H	LC
60	FAGACEAE	<i>Quercus macranthera</i> Fisch. et Mey. subsp. <i>sypirensis</i> (C. Koch) Menitsky	U	Ph	LC
61	RUBIACEAE	<i>Asperula cymulosa</i> (G. Post) G. Post	EM	H	VU
62	RUBIACEAE	<i>Asperula stricta</i> Boiss. subsp. <i>latibracteata</i> (Boiss.) Ehrend.	IT	H	LC
63	IRIDACEAE	<i>Iris kerneriana</i> Ascherson et Sint. ex Baker	ES	G	LC
64	POACEAE	<i>Festuca cappadocica</i> (Hackel) Markgr.-Dannenb.	IT	H	LC
65	POACEAE	<i>Festuca longipanicula</i> Markgr.-Dannenb.	IT	H	NT

TABLE 4. The distribution of endemic plant taxa according to life form [33].

	Life Form	Number of Endemic Taxa	Percentage (%)
1	Hemicryptophyte (H)	50	76.92
2	Chamaephyte (Ch)	6	9.23
3	Therophyte (Th)	5	7.69
4	Phanerophyte (Ph)	3	4.62
5	Geophyte (G)	1	1.54
	Total	65	100

#### 4. DISCUSSION AND CONCLUSION

In the Deveci Mountains, five different vegetation types; coniferous and deciduous forest, scrub, steppe, rocky and wet grassland are present. Collected samples from all mentioned vegetation types were determined to represent 456 taxa and 262 genera to be related to 63 families [34]. 65 plant taxa were found to be endemics and endemism rate is 14.25%. Threat categories and number of endemic plant taxa fitting in the threat categories were given in Table 5.

Highest number of endemic taxa belonged to *Fabaceae* and *Lamiaceae* each by 16.92%. As the phytogeographical distributions of endemic taxa were analyzed it is seen that Irano-Turanian (53.85%), Eastern Mediterranean (4.62%), Euxine (3.08%), Euro-Siberian (1.54%) were represented. But phytogeographical origin of 36.92% of endemic taxa were unknown (Table 2).



TABLE 5. Number of endemic plant taxa determined from Deveci Mountains and their threat categories.

	Threat Category	Number of Endemic Taxa	Percentage (%)
1	Endangered (EN)	1	1.54
2	Vulnerable (VU)	4	6.15
3	Near Threatened (NT)	7	10.77
4	Least Concern (LC)	53	81.54
	Total	65	100

In the study area; when the plant taxa were classified and analysed according to Raunkiaer's life forms [33], Hemicryptophytes were determined to be the most common plant taxa (76.92%), Chamaephytes come next (9.23%), is followed by the Therophytes (7.69), and then come Phanerophytes (4.62). While Geophytes have the least number of plant taxa with 1 species (1.54%) (Table 4).

As the threat categories were analyzed, one taxon was found to be (1.54%) Endangered, four (6.15%) taxa were found to be Vulnerable, seven (10.77%) taxa were found to be Near Threatened according to IUCN criteria, while remaining 53 taxa (81.54%) were found to qualify for Least Concern category (Table 5).

In the coming years, we expect this study will contribute to efforts of protecting the biodiversity of Turkey.

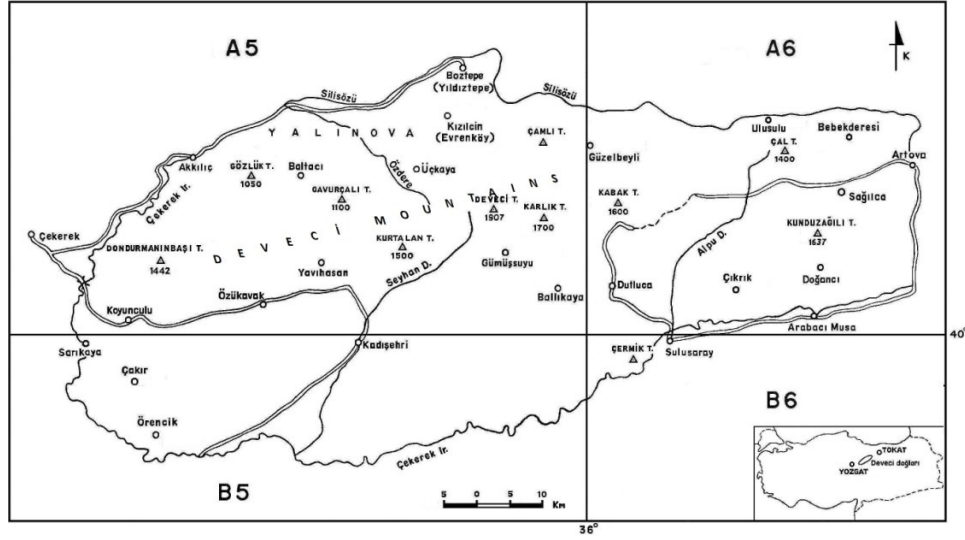


FIGURE 1. Map of study area [8, 9].

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