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THE CURRENT SITUATION OF THREATENED ENDEMIC FLORA IN TURKEY: KEMALIYE (ERZİNCAN) CASE

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Abstract

The flora in Turkey is an outstanding one in terms of its biodiversity and the variety of endemic plant species. In this study, efforts have been made to determine the current situation of Turkey in general and local region (Kemaliye), being rich for endemic plants, based on International Union for Conservation of Nature and Natural Sources (IUCN) in order to present abundancy of endemic plants in Turkey and conditions in which endemic plant have been threatened. Of 3504 endemic plants in Turkey, 12 are known to have been extinct and 3492 (99 %) are still being threatened. Of 61 endemic plants in Kemaliye region, 5 is known to have been extinct and 54 (88%) to be threatened. This study provides some suggestions about conservation and management of such plants by considering their threatened categories.

Introduction

Biological diversity consists of three hierarchical categories viz., gene, species and ecosystem. Species diversity implies the diversity of species in a certain region or all over the world (Anon., 2001). According to Hunter (1996), biodiversity consists of five components: 1) genetic, 2) species, 3) community, 4) landscape and 5) process or function (Kaya & Raynal, 2001).

The fact that a plant grows only in a certain local area is defined as endemism. In other words, plants which can grow only in a specific and limited region on the earth's surface are called endemic plants. The borders of endemism are sometimes natural and sometimes administrative or political. Any species of plants may be endemic to a chain of islands, a particular country or a particular region or province of that country (Anon., 1999). Myers (1988) states that plant/animal endemism is the major concern in critical status determination since endemics are dependent on a single area for their survival, and by their limited range, are under the risk of extinction (Behera *et al*., 2005). Heywood & Watson (1995) point out that endemic plants, cramped to extremely threatened ecosystems, are under the risk of extinction and need efficient and swift action for better conservation (Behera *et al*., 2005). Factors such as genetic drift and inbreeding in small populations and reduced gene flow among remnants, not only *rare* but also *endemic* species are expected to show reduced levels of genetic variation (Young *et al*., 1996).

The flora of a country combined with its natural sources forms country's richness. The richness of a country's flora is determined based on the level of endemism in the country as well as the existence of other plants. The ecological planning studies in a country should also include endemic plants conservation programs so that the sustainability of natural sources can be guaranteed. It is commonly accepted that endemic plants have an important place in the biodiversity. Many researches carried out in the field focuses on the importance of endemic plants and proposes some alternative preservation methods (Waldren *et al*., 1995; Médail & Verlaque, 1997, Laguna *et al*.,

2004; Riemann & Ezcurra 2005; Casazaza *et al*., 2005). Andelman & Willig (2003) argue that it is a critical and urgent task to create networks of nature reserves to shelter areas rich in biodiversity from the adverse impacts of anthropogenic transform. Fraga (2006) defines the term "conservation" as "the study and management of representative samples of natural communities and/or ecosystems so as to preserve them as a function of development and in benefit of present and future human populations".

Today, the process of protecting particularly valuable habitats is crucial. According to Waldhardt (2003) the preservation of biodiversity can be achieved only through the (re)establishment of a mosaic of suitable habitat patches at the landscape scale. According to the World Resources Institute (WRI), the World Conservation Union (IUCN) and United Nations Environmental Programme (UNEP) (1992), a structure of conserved parks or reserves is vital for the protection of a country's biological diversity (Shafer, 1999). Recently, many experts in this field have stressed out the idea that the organization of a system of protected areas is critical to nature and landscape conservation (WRI/IUCN/UNEP, 1992, Andelman & Willig, 2003 and Waldhardt, 2003).

The aims of this study are (1) to define the threatened category of endemic plants in a region rich with endemic plants of Turkey in general and local region (Kemaliye), where a rich biodiversity is observed and (2) to present some suggestions concerning the preservation of endemic plants.

The endemic plants in Turkey: Having a number of natural habitats, ranging from Mediterranean, Aegean and Black Sea coasts to towering coastal and interior mountains, from deeply incised valleys to expansive steppes, from fertile alluvial plains to arid, rocky hill slopes, Turkey really deserves much more attention. Numerous community types and habitat mosaics, containing a rich mixture of plant and animal species many of which are endemic, crop up in this country (Anon., 1999). Kaya & Raynal (2001) state that composite interactions among species and with their abiotic environment exist and the dynamics of habitat change over an exceedingly long period of human cultural history in the region which have added an ever-changing dimension to ecosystem and landscape character. Turkey's varied ecological characteristics and the extremely diverse ecosystems, have enabled Turkey to be a home for large variety of species and subspecies that are peculiar to the region and therefore, defined as endemic

Many floristic studies have shown that Turkey has a rich diversity of species and is an active species-formation center and Turkey is one of the world's most important countries in terms of endemic plants (Davis, 1965-1982, Atalay 1997, Ekim *et al*., 2000). Flora records reveal that there are more than 3000 endemic plants in Turkey, which constitutes 34% of total flora (Anon., 2005a). The distribution of endemic plants of Turkey according to main phytogeographical regions is as follows:
1220 in Irano-Turanien phytogeographic region,
1050 in Mediterranean phytogeographic region and
300 Euro-Siberian phytogeographic region.

What phytogeographic other remaining endemic taxa belong to have not been clearly determined yet. These taxa can be found mostly in transition regions and therefore, are not known which is regions mentioned above they belong to (Ekim *et al*., 2000).

Endemic plants in Turkey include both those localized endemics in certain mountains and mountain ranges and those which are more widespread. The richest locality in terms of endemic plants in a specific mountain or range is the Amanos

Mountains. Other mountains rich in endemic are the mountains at the southern tip of the Aegean region and in the western Mediterranean region as well as Mt. Uludağ, Kaz Mountain and Mt. Erciyes. Apart from certain mountains, following are the regions which are worth mentioning in terms of endemism: Toros ranges, (among Ermenek, Gülnar, Mut), Antitoros region (Saimbeyli and Kahramanmaraş), the area including Van-Siirt-Bitlis and Hakkari, great mountains around Rize and Artvin, Lake Tuz and the geography close to it are famous with halophilic endemics (Anon., 1999, Anon., 2005a).

Most of the endemic plants in Turkey are threatened. The threatened category-based on the classification of endemic taxa found in the Red Data Book of Turkish Plants (2000) can be seen in Table 1 (Ekim *et al*., 2000).

Table 1. The threatened category-based classification of endemic taxa found in the Red Data Book of Turkish Plants is as follows :

	EX[1]	EW[1]	CR[1]	EN[1]	VU[1]	LR(lc)[1]	LR(cd)[1]	LR(nt)[1]	DD[1]	NE[1]	Total number
Endemic plants	12	-	171	774	688	769	470	347	270	3	3504

The endemic plants grown in Turkey face great deal of difficulties in sustaining their generations due to various threats. The main threats to the survival of Turkey's endemic plants are; clearing grounds for fields, overgrazing and reform of barren lands, construction of dams, industrialization and urbanization, exportation and domestic use, plant protection and pollution, tourism, forestation and fires (Ekim *et al*., 2000, Anon., 1999).

The endemic plants in Kemaliye (Erzincan) district and nearby: Some of the important regions in terms of endemic plants in Eastern Anatolia are Munzur mountains and Van-Hakkari-Bitlis districts and nearby. The number of endemic plants to Eastern Anatolia has been found to be 380 (Ekim *et al*., 2000). Kemaliye district, where the threatened category of endemic plants were examined is located in Eastern Anatolia Region (1007 km^2, 39^0 15' 00'' North Latitudes and 38^0 30' 00'' East Longitudes) in Erzincan province (Anon., 2005b and 2005c).

The nearby of Kemaliye district is under the influence of prevailing climate of Eastern Anatolia; terrestrial climate. However, the valley in this region sometimes can have the characteristics of Mediterranean climate (Demirsoy, 2004). Kemaliye district is located in Irano-Turanien phytogeographic region, one of the three regions taking place in Turkey, also is situated in B7 square according to Davis, (1965-1982) square system (B7 is a part of grid system, which is a square system of Turkish flora). Due to its interesting geomorphologic and geological form, topography, micro climatic characteristics and natural values, Kemaliye and nearby has the potential to be a national park (Yildirimli, 1989).

The endemic species in Kemaliye district and nearby has been collected from the study "Flora of Munzur Mountains" by Yıldırımlı (1995). Besides, the threatened category of endemic species is presented after the analysis based on Red Data Book Categories of International Union for Conservation of Nature and Natural Resources (IUCN).

[1]EX-EXTINCT, EW*-EXTINCT IN THE WILD, CR*-CRITICALLY ENDANGERED, EN*-ENDANGERED, VU*-VULNERABLE, LR*-LOWER RISK, (cd) CONSERVATION DEPENDENT, (nt) NEAR THREATENED, (lc) LEAST CONCERN, DD*- DATA DEFICIENT- , NE*-NOT EVALUETED

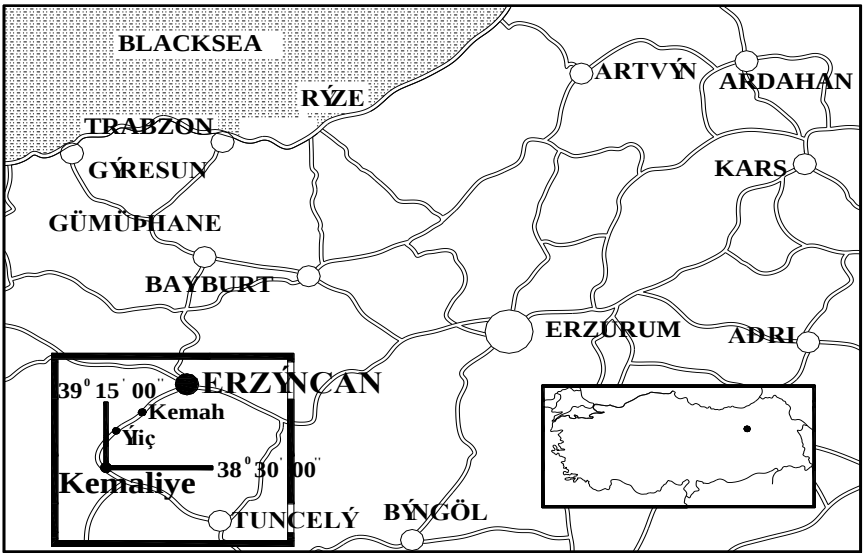

Fig. 1. Location of Turkey and Kemaliye (Erzincan).

The examination of the plant species in Kemaliye and nearby (Yıldırımlı, 1995) revealed that 61 of these plants are endemic (Table 2). Ninety families account for 61 of the endemic species on the Cape Peninsula (Yildirimli, 1995) (Table 3).

Of these plants, 45 is categorized as species and 6 as subspecies and 8 as variety (Yildirimli, 1995) (Table 3). When the plants are analyzed according to threatened categories, 59 (96%) of them are found to be in danger. (Table 4). The categorization of the endemic taxa found in Kemaliye and nearby can be seen in Table 4.

Of the endemic plants in Kemaliye dictrict and nearby, 5 have already been extinct, and 54 are in critically endangered category and 9 in endangered category and finally 6 in vulnerable category (These datas were constituted in the threatened category-based classification of endemic taxa found in the Red Data Book of Turkish Plants written by Ekim *et al*., 2000).The remaining are also the endemics in need of protection. The factors treatening the endemics in this region can be listed as; the industrialization and urbanization, over grazing, exportation and domestic use, agricultural fight and pollution and fires.

Discussion

Of the 3504 endemic plants in Turkey,12 have already been extinct and 3492 are threatened (Table 1) (Ekim *et al*., 2000). Of 61 endemic plants in Kemaliye and nearby (Yildirimli,1995), 5 have already been extinct and 54 are in danger (These datas were constituted in the threatened category-based classification of endemic taxa found in the Red Data Book of Turkish Plants written by Ekim *et al*., 2000) (Table 5).

Studies of the flora and endemic plants of Turkey have taken a long way especially since the nineteenth century. Among governmental organizations, the Ministry of Environment and Forestry and the Ministry of Agriculture and Rural Affairs are directly concerned with the subject of endemic plants. In a study funded by State Planning Organization (DPT) through The Scientific & Technological Research Council of Turkey (TUBITAK), seeds of endemic plants are collected and stored in two seed banks since 1992 (Anon., 1999).

Table 2. Families of Kemaliye (Erzincan) district and nearby endemics (Yildirimli,1995).

Family	Number of endemic species
Brassicaceae (Cruciferae)	5
Caryophyllaceae	3
Polygonaceae	1
Hypericaceae (Guttiferae)	1
Geraniceae	1
Fabaceae (Leguminocea)	6
Apiaceae (Umbelliferae)	2
Rubiaceae	1
Dipsacaceae	1
Asteraceae (Compositae)	7
Campanulaceae	2
Boraginaceae	5
Scrophulariaceae	7
Lamiaceae (Labiatae)	10
Santalaceae	1
Liliaceae	5
Iridaceae	1
Orchidaceae	1
Cyperaceae	1

Volunteer organizations include the Environment Foundation of Turkey, Turkish Society for the Protection of Nature and the Foundation for the Protection of Nature in Turkey. It is hard to say that there are enough detailed data for the Turkish flora. Another reason is not to have a center for organization and exhibition of these studies, such as a 'National Herbarium and Botanical Garden'. Regarding international studies, the most important ones are with World Wildlife Fund (WWF), International Union for Conservation of Nature and Natural Resources (IUCN), United Nations Environment Programme (UNEP), International Board for Plant genetic Resources (IBPGR) and OPTIMA. Additionally, Turkey has been ratified the Bern treaty on protection of endangered plants in their habitats, CITES convention on Control of International Trade of Plants and Animals and RAMSAR convention on protection of wetlands (Anon., 1999).

Resent studies are focused on conservation of the endemic plants such as in Southern Africa (Hall *et al*., 1984), in Iberia (Gómez-Campo & Herranz-Sanz, 1993), in Oman (Ghazanfar, 1998). It should also be stated that creating monitoring programs and building quantitative databases for preservation programs will be crucial to achieve future success in maintaining biodiversity in Turkey (Kaya & Raynal, 2001).

In recent studies, recommedations about the endemic plants are; conservation programs and floristic surveys (Waldren *et al*., 199), *In situ* protective action programs (Médail & Verlaque, 1997), *Ex situ* conservation programs (i.e., repopulating of dropped populations, conservation of genetic patterns etc.) (Casazza *et al*., 2005), scientific studies to analyse population viability of endemic plants (Médail & Verlaque, 1997), conservation status such as 'Micro reserves' statutory to be created by Reginel Services (Laguna *et al*., 2004), creation of several protected areas (Riemann & Ezcurra 2005) and nature reserves (Casazza *et al*., 2005) and rehabilitation or restoration of damaged habitats (Casazza *et al*., 2005).

Table 3. List of the endemic Angiosperm taxa of the Kemaliya (Erzincan) district and nearby (Yildirimli,1995).

Family	Species
Brassicaceae (Cruciferae)	*Isatis undulata* Aucher ex Boiss. End., Ir.-Tur. –EN
	Aethionema eunomioides (Boiss.) Bornm. End., Ir.-Tur. - LR (lc)
	Alyssum oxycarpum Boiss. et Bal. End., East Medit. -LR (cd)
	Barbarea auriculata Hausskn. ex Bornm. var. *auriculata* End., Ir.-Tur.-EX
	Erysimum eginense Hausskn. ex Bornm. End., Ir.-Tur.-VU
Caryophyllaceae	*Areneria acutisepala* Hausskn. ex Williams End., Ir.-Tur.-LR (lc)
	Minuartia glandulosa (Boiss. et Huet) Borrnm. End., Ir.-Tur. -LR (lc)
	Minuartia erythrosepala (Boiss.) Hand.-Mazz. var. *cappadocica* (Boiss.) McNeil End., Ir.-Tur. - LR (lc)
Polygonaceae	*Atraphaxis grandiflora* Willd. End., Ir.-Tur. - LR (lc)
Hypericaceae (Guttiferae)	*Hypericum pumilio* Bornm. End., Ir.-Tur.–EN
Geraniceae	*Geranium eginense* Hausskn. et. Sint. Ex Knuth End., Ir.-Tur.-EN
Fabaceae (Leguminocea)	*Astragalus densifolius* Lam. End., Ir.-Tur. (Geven)-E
	Astragalus pseudocylindraceus Bornm. End., Ir.-Tur. -EX
	Astragalus cadmicus Boiss. End., Ir.-Tur. -LR (lc)
	Astragalus syringus Chamb. End., Ir.-Tur.-EN
	Trigonella isthmocarpa Boiss. et Bal. End., Ir.-Tur.-VU
	Trigonella rhytidocarpa Boiss. et Bal. End., Ir.-Tur. -LR(nt)
Apiaceae (Umbelliferae)	*Prangos platychloenae* Boiss. ex Tchih. End., Ir.-Tur. -E
	Bupleurum eginense (Wolff) Snogerup End., Ir.-Tur.-LR (nt)
Rubiaceae	*Galium runcinatum* Ehrend. et Schönb. Tem. End., Ir.-Tur. – VU
Dipsacaceae	*Pterocephalus pinardii* Boiss. End. East Medit. -LR (lc)
Asteraceae (Compositae)	*Inula fragilis* Boiss. et Hausskn. End., Ir.-Tur. -VU
	Cousinia intertexta Freyn et Sint. End., Ir.-Tur.-LR (cd)
	Jurinea cataonica Boiss. et Hausskn. End., Ir.-Tur.- LR(lc)
	Centaurea psephelloides Freyn et Sint. End., Ir.-Tur. -DD
	Scorzonera inaequiscapa Boiss. End., Ir.-Tur. -LR (nt)
	Tragopogon fibrosus Freyn et Sint. ex Freyn End., Ir.-Tur. -EN
	Hieracium bornmuelleri Freyn. End., Ir.-Tur. -LR (lc)
Campanulaceae	*Campanula yildirimlii* Kit Tan et Sorger End., Ir.
	Campanula ptarmicifolia Lam. var. ptarmicifolia End., Ir.
Boraginaceae	*Paracaryum cappadocicum* Boiss. et Bal. End., Ir.-Tur.-LR (lc)
	Onosma discedens Hausskn. ex Bornm. End., Ir.-Tur. -EX
	Onosma affine Hausskn. ex Riedl. End., Ir.-Tur.- EX
	Cynoglottis chetikiana Vural et Kit Tan subsp. *paphlagonica* (Hausskn. ex Bornm.) Vural et Kit Tan End.-LR (lc)

End. : Endemic, Ir.-Tur.: Irano Turanien

Table 3. (Cont'd.).

Family	Species
	Alkanna megacarpa DC. End., Ir.-Tur.-LR (lc)
Scrophulariaceae	*Verbascum calycosum* Hausskn. ex Murb. End., Ir.-Tur. -EX
	Verbascum leiocarpum Murb. End., Ir.-Tur.-EN
	Scrophularia libanotica Boiss. subsp. *libanotica* var. *cappadocica* R. Mill End., Ir.-Tur. (Sıraca otu, esmer kök)-LR (lc)
	Scrophularia libanotica Boiss. subsp. *libanotica* var. urartuensis R. Mill End., Ir.-Tur. - LR (lc)
	Scrophularia libanotica Boiss. subsp. *armena* R. Mill End., Ir.-Tur.-LR(nt)
	Cheanorhinum cryptarum (Boiss. et Hausskn.) Davis End., Ir.-Tur.-CR
	Pedicularis cadmea Boiss. End. East Medit. (mt.)-LR (lc)
Lamiaceae (Labiatae)	*Scutellaria salviifolia* Bentham End., Ir.-Tur.-LR (lc)
	Scutellaria orientalis L. subsp. *bicolor* (Hocht.) Edmondson End., Ir.-Tur.-LR (lc)
	Phlomis oppositiflora Boiss. et Hausskn. End., Ir.-Tur.- LR (lc)
	Marrubium parviflorum Fisch. et Mey subsp. *oligodon* (Boiss.) Seybold End., Ir.-Tur. - LR (lc)
	Stachys tundjeliensis Kit Tan et Sorger End., Ir.-Tur.-EN
	Stachys ramosissima Montbret et Aucher ex Bentham var. ramosissima End., Ir.-Tur.-LR(cd)
	Stachys burgsdorffioides (Bentham) Boiss. *ladanoides* Hand.-Mazz End., Ir.-Tur.-LR (nt)
	Origanum haussknechtii Boiss. End., Ir.-Tur. -LR(cd)
	Origanum munzurense Kit Tan et Sorger End., Ir.-Tur. -EN
	Cyclotrichium niveum (Boiss.) Manden. et Scheng End., Ir.-Tur. –VU
Santalaceae	*Thesium tauricolum* Boiss. et Hausskn. End., Ir.-Tur.-LR (nt)
Liliaceae	*Muskari coeleste* Fomin End., Ir.-Tur -LR(lc)
	Hyacinthus orientalis L. subsp. *chionophilus* Wendelbo End., Ir.-Tur. -LR (nt)
	Bellevalia gracilis Feinbrun End., Ir.-Tur. -LR (lc)
	Hyacinthella acutiloba K. Person et Wendelbo End., Ir.-Tur. -LR(cd)
	Tulipa armena Boiss. var. *lycica* (Baker) Marais End. -LR (lc)
Iridaceae	*Iris sari Schott* ex Baker End., Ir.-Tur. -LR(lc)
Orchidaceae	*Dactylorhiza osmanica* (Kl.) Soó var. *osmanica* End., Ir.-Tur. -LR(lc)
Cyperaceae	*Carex eriocarpa* Hausskn. et Kük. End., Ir.-Tur.- LR (cd)

Table 4. The number of endemic plant species in Kemaliye (Yildirimli,1995) district (These datas were constituted in the threatened category-based classification of endemic taxa found in the Red Data Book of Turkish Plants written by Ekim *et al*., 2000)

	Family	Species	Subspecies	Variety	Total number
Endemic plants	19	47	6	8	61

Table 5. Classification of endemic plants in/around Kemaliye (Yildirimli,1995) in terms of the risks they face (These datas were constituted in the threatened category-based classification of endemic taxa found in the Red Data Book of Turkish Plants written by Ekim *et al*., 2000).

The endemıc plants ın kemaliye (erzincan) dıstrıct and nearby	EX	EW	CR	EN	VU	LR(lc)	LR(cd)	LR(nt)	DD	NE	Total number
Endemic	5	-	1	9	6	24	6	7	1	-	**59**

Conclusion

Turkey is quite rich in terms of endemic plants. Where 3492 (Ekim *et al*., 2000) (99 %) endemic plants in Turkey are threatened. But a comprehensive conservation program has not been established yet. Turkey needs a long-term conservation program for endemic plants.

This study carried out a careful evaluation of conservation techniques suggested for endemic plants in danger in other studies and proposed a conservation and management program for the threatened endemic plants in Turkey. The following practical conservation measures should be prioritized in Turkey:

1. A country-wide conservation policy concerning endemic plants should be established in Turkey. An organization of a system of avaliable conserved areas must be done.
2. *In situ* conservation system should be established for endemic plants. Also, conservation status like "Natural Reserve" and "Microreserve" should be developed to conserve endemic plants.
3. *Ex situ* conservation system should be established for endemic plants (conservation of genetic patterns etc.)
4. The research on endemic plants should be supported by governments, universities and private sector etc.

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