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Plant species microendemism, rarity and conservation of pseudo - alpine zone of Kazdağı (Mt. Ida) national park - Turkey

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Abstract

Kazdag (Mt. Ida) forms a natural border between the Provinces of Canakkale and Balıkesir in the north-western part of Turkey. It was declared as National Park in 1993 because of its rich plant cover, a restricted zone of *Abies nordmanniana* ssp. *equi-trojani* forest, natural beauty and mythology. The pseudo-alpine zone consists of 189 specific and infraspecific taxa of vascular plants. A total of 55 endemic taxa (29.10%) were recorded from this area. Out of these 22 (40%) taxa are restricted only to this area, and 5 taxa are non-endemic but rare in Turkey. In this paper, habitat characteristics, conservation strategies and management of these taxa are given. Our investigations revealed that, out of 55 taxa, 12 are critically endangered (CR), 10 endangered (EN), 11 vulnerable (VU), 9 not threatened (NT) and 18 with lower risk (LC). Although *Hieracium idae*, *Dianthus arpadianus* var. *trojanus*, *Minuartia garckeana* and *Paronychia sintenisii* are recorded as data deficient (DD) category in IUCN criteria, these taxa are transferred to CR category.

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1. Introduction

All floristic studies undertaken in Turkey depict that biodiversity hotspots are of global priority for conservation due to their species richness and ratio of endemism. WWF has published the report which includes 122 important plant areas (OBA) whereas nature association (DD) has identified 305 key biodiversity areas (KB) on the basis of endemism in Turkey [6, 37]. Kazdağı (Mt. Ida) situated in north-west Anatolian part of Turkey is one among these important nature areas. It lies between 39° 42' N latitudes and 26° 51' E longitudes. The highest peaks are Karatas hill (1774 m), Cilbak (1765 m) and Sarikiz (1720 m) [49] (Fig.1). The mountain forms a natural border between the Marmara and Aegean Regions, but phytogeographically it occupies the transition zone between Euro-Siberian and Mediterranean, with Irano-Turanian impacts in some areas. The summit of this mountain is called Karatas peak, which experiences a Mediterranean climate with an average temperature of 14.88 °C, the highest average temperature

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being 30.9 °C and the lowest -6.7 °C, and annual precipitation is 1500 mm m⁻² [33]. The precipitation regime is typical Mediterranean type with rainy winters. The aridity period is between June and September.

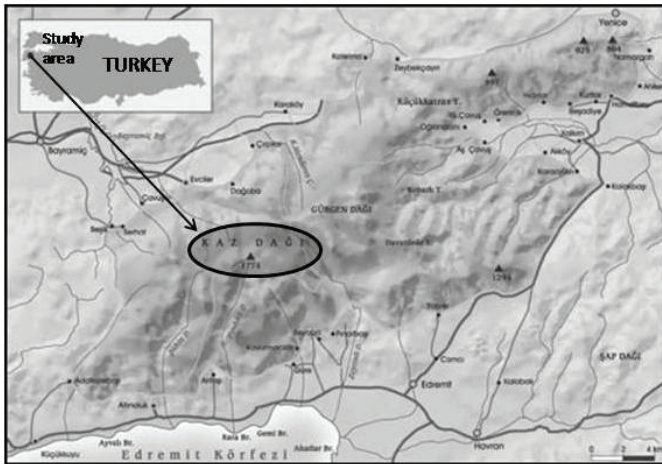


Fig. 1. Map showing the location of Kazdağı.

Kazdağı is a doubly plunging, NE-SW trending anticlinorium as a geological and geomorphological entity. Geologically it is composed of mainly high degree metamorphosed basement and sedimentary cover rocks. The metamorphic basement rocks are represented by gneiss, amphibolites, schist, marble, metaophiolite, migmatite and metagranites. The metamorphic rocks here are in the tectonic contact with Permian to Miocene sedimentary rocks and are intruded by the Oligo-Miocene granitoids. Pliocene and younger sedimentary rocks cover all these units with an unconformity. The mountain has attained its

present morphology after Miocene time, which got uplifted as metamorphic core complex by detachment faults (Fig. 2) [30].

The summit is windswept and bare with a relatively low tree-line due to exposure, but the slopes are at the edge of mild Mediterranean and colder continental climate zones, which hold a wealth of endemic flora, marooned here after the Ice Age. The climate at lower altitudes is hot and dry in the deforested landscape. The forests on the upper slopes consist mainly of Turkish Fir (*Abies nordmanniana* ssp. *equi-trojani*), which is mentioned as a distinct species *Abies equi-trojani* by some workers. The wood used for making Trojan horse is said to have been cut from these firs, but real evidence is lacking [49]. The presence of these unique fir forests has been the main reason for the declaration of south side of Kazdağı as a national park in 1993 [32]. From 1998 onwards much work has been done in the area. One of these studies is related to the project entitled “In Situ Conservation of Genetic Diversity in Turkey and in situ Gene Management Zones (GMZS)” supported by World Bank Global Environment Facility (GEF) [52].

The mountain is floristically included in the grid-square B1 [10]. Many investigators starting from the year 1779 have collected plants from this area [13]. The ecology and vegetation of the area too has attracted the attention of many workers [1,2,3,7, 14,15,16,17, 18, 23,24,31,35,36,48,51,54,55,57,59,60].

2. Ethnology of Kazdağı

There are actually two mountains with the same name in the Mediterranean, first one on the Island of Crete (Greece) known as “Mount Ida” the legendary birthplace of the king of the ancient gods and sacred to the goddess Rhea, with a cave in which Zeus was reared. The second one is Kazdağı (Mount Ida-Mount of Goddess) the mountain, in the environs of ancient TROY-northwest Anatolia and both are recorded as sacred. The mountain is known as one of the oldest settlements from antique period, a cradle of rich and poetic myths, with 1001 springs amidst the lush green plant cover. Famous legendary person Paris was brought up here, fell in love with the nymph Oinone here. First beauty competition in the world was held here and Aphrodite was declared as the most beautiful woman. Mythologically after the decision of Zeus three goddesses Hera, Athena and Aphrodite were led by Hermes to Mount Ida (near Troy) in order to be judged by Paris. It is the place where the marriage ceremony of beautiful sea mermaid Thetis and Peleus took place and here Aphrodite won the apple of Eris, Paris the hand of Helen and World the Trojan War [9].

The mountain in Turkey was inhabited by nomadic Turkmen and Yoruk tribes who immigrated to Anatolia after 1071. The Turkmen tribes also consider it as a sacred mountain. Some stories are narrated regarding the Turkmen shepherd Baba Cilbak, his daughter Sarikiz (Golden Maiden) and the goose, who were living in the village of Gure near Edremit. The summit Sarikiz Peak is named after the daughter and the place where her father died is called Baba Dagi. Every year in the third week of August a special ceremony is organized here by the nomadic Turkmen tribes. The visitors come to the open tomb, light candles, write in the tomb’s notebook or collect small wish stones around the tomb [8].

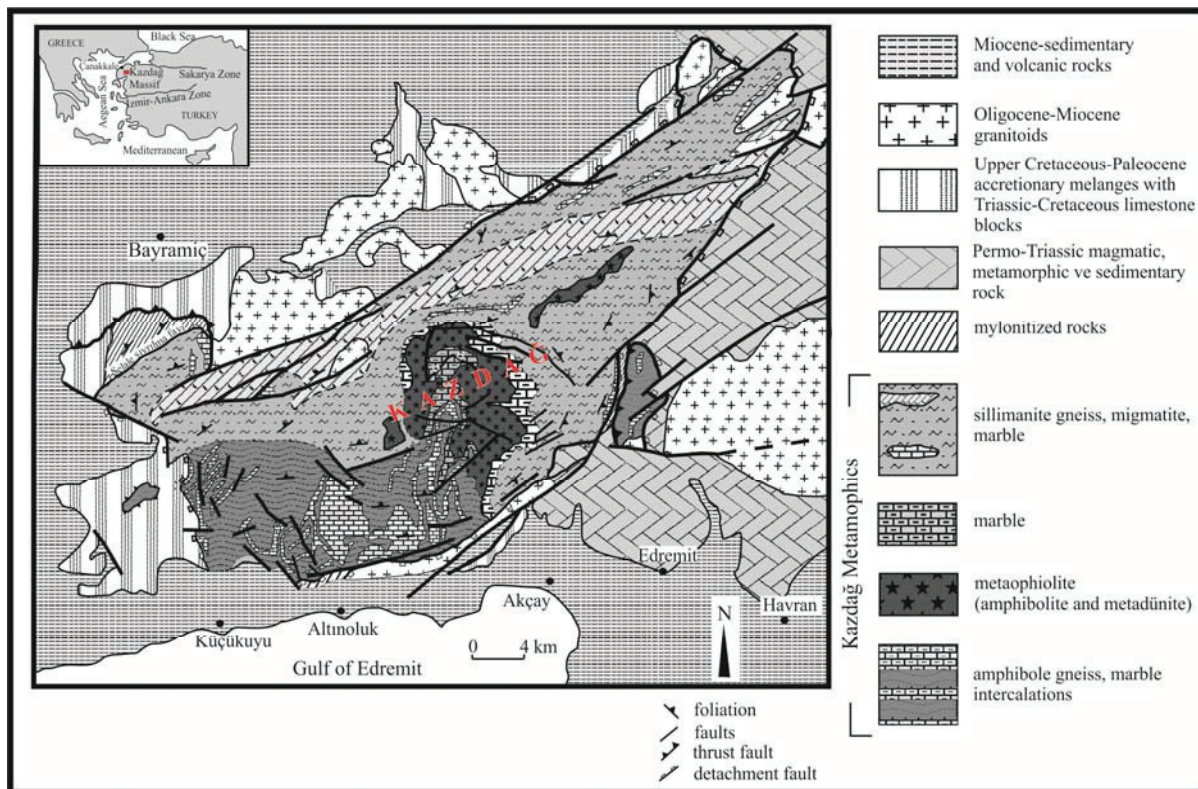


Fig. 2. Map showing geological features of Kazdağı (Duru *et al.*, 2004).

3. Methods

The pseudo-alpine zone was visited on seasonal basis between 2003-2009 and specimens were collected. These were dried and are deposited at the Canakkale Onsekiz Mart University Herbarium of Biology Department. The specimens were identified with the help of Flora of Turkey and the East Aegean Islands [11,12] and Flora Europaea [53]. For re-evaluation of threat status of taxa ecological and geographical data was collected and compared with the Red List criteria [20, 28]. The author abbreviations were scanned in the International Plant Names Index (<http://www.ipni.org>) and Authors of Plant Names [5].

4. Results

Phytogeographically Turkey occupies an important position in the world from the viewpoint of plant genetic resources and genetic diversity. It is a meeting place for the two Centres of Diversity and Origin; the Near East and the Mediterranean which overlap here. This location together with a great variety of geomorphologic, topographical and climatic features is responsible for its large diversity of habitats and richness of plants vis-à-vis their endemism. The number of taxa lies around 8745, with 3300 endemics [19,40,41]. Very recently about 1.000 new taxa have been listed by Guner *et al.* [27]. According to the “In-Situ Protection of Genetic Resources Project” which aims at the protection of wild relatives of cultivated plants as important sources from the point of view of global dimension the forest areas have received a special attention. One of these areas is Kazdağı due to its rich plant diversity and endemism [56]. This mountain is the gene centre of West Anatolian region. The endemic and rare taxa have been preserved on different geological massifs and especially in the pseudo alpine zone. Our observations and the papers published on this mountain reveal that nearly 800 vascular plant taxa belonging to 101 families show distribution on this mountain. The high mountain vegetation comprises of four plant communities depending on rock types. The pseudo-alpine zone of this mountain is a composite of high-altitude enclaves.



Fig. 3. Some endemic and rare plants and their habitats on Kazdağı. A. Siliceous pasture, B. Calcareous rocks, C. *Matthiola trojana*, D. *Asperula sintenisii*, E. *Thymus pulvinatus*, F. *Hypericum kazdaghense*, G. *Sideritis trojana*, H. *Armeria trojana*, I. *Achillea frasii* var. *trojana*, J. *Centaurea athoa*, K. *Allium kurtzianum*, L. *Linum boissieri* (Photos: E. Karabacak).

In all 189 specific and infraspecific taxa of vascular plants belonging to 132 genera and 52 families were collected from the pseudo-alpine zone. The number of endemics in this zone is 55 with a ratio of 29.10 percent and 22 of these (40 %) are completely restricted to this area. Our plant collection trips in the area since 1988 revealed that these taxa are spread over different habitats like rocky slopes, calcareous grassland, sub-alpine grassland, calcareous peaks, calcareous slopes, calcareous rocks, mountain rocks, mountain grassland, mountain step, mountain slopes, moss covered areas, forest clearings, alpine grasslands, gravels, rocky scrubs, under forest, coppices, watersides, siliceous rocks, rocky grassland, pastures, scrubby slopes, and siliceous slopes. A major number of taxa is found on schist and calcareous rocks covered by non-calcareous brown forest soil [31]. Although ratio of endemism is lower than general flora of Turkey (34%), it is higher than overall floral endemism in West Anatolia. The red list categories of the endemic and non-endemic rare species according to IUCN [28] are given in table 1. The table shows that out of 55 taxa 12 are critically endangered (CR), 10 endangered (EN), 11 vulnerable (VU), 9 not threatened (NT) and 18 with lower risk (LC). Although *Hieracium idae*, *Dianthus arpadianus* var. *trojanus*, *Minuartia garckeana* and *Paronychia sintenisii* are recorded as data deficient (DD) category in IUCN criteria, these taxa are transferred to CR category (Table 2).

Table 1. Endemic and rare plant list pseudo-alpine zone in Kazdağı Mountain (asterisk (*) is given as non-endemic but rare taxa)

Plant Name	Family	Pattern	IUC	Habitat and substrate
<i>Abies nordmanniana</i> (Stev.) Spach subsp. <i>equi-trojani</i>	Pinaceae	Tree	NT	Forest
<i>Acer hyrcanum</i> Fisch. & Mey. subsp. <i>keckianum</i> (Pax.)	Aceraceae	Tree	NT	Coppices
<i>Ächillea fraasii</i> Sch.Bip. var. <i>troiana</i> Heimerl	Asteraceae	Herbaceous	CR	Calcareous rocks
<i>Achillea nobilis</i> L. subsp. <i>sipylea</i> (O.Schwarz) Bässler	Asteraceae	Herbaceous	NT	Calcareous rocks
<i>Alchemilla hirsutiflora</i> (Buser) Rothm.	Rosaceae	Herbaceous	VU	Forest and waterside
<i>Allium kurtzianum</i> Asch. & Sint. ex Kollmann	Alliaceae	Bulbous	EN	Mountain slopes
<i>Allium phrygium</i> Boiss.	Alliaceae	Bulbous	LC	Mountain steppe
<i>Allium sibthorpiatum</i> Schult.f.	Alliaceae	Bulbous	LC	Calcareous rocks
<i>Armeria trojana</i> Bokhari & Quézel	Plumbaginaceae	Herbaceous	EN	Siliceous rocks
<i>Asperula sintenisii</i> Asch. ex Bornm.	Rubiaceae	Sub-scrub	EN	Siliceous rocks
<i>Astragalus heldreichii</i> Boiss.	Fabaceae	Scrub	VU	Rocky grassland
<i>Astragalus idae</i> Sirjaev	Fabaceae	Scrub	VU	Alpine grassland, rocks
<i>Asyneuma rigidum</i> (Willd.) Grossh. subsp.	Campanulaceae	Herbaceous	LC	Rocky slopes, pastures
<i>Asyneuma virgatum</i> (Labill.) Bornm. subsp.	Campanulaceae	Herbaceous	LC	Rocks
<i>Bromus sipyleus</i> Boiss.	Poaceae	Herbaceous	EN	Scrubby slopes
<i>Carduus nutans</i> L. subsp. <i>falcato-incurvus</i> P.H.Davis	Asteraceae	Herbaceous	NT	Calcareous rocks
<i>Carduus nutans</i> L. subsp. <i>trojanus</i> P.H.Davis	Asteraceae	Herbaceous	NT	Calcareous rocks
<i>Carex distachya</i> Desf. subsp. <i>phyllostachioidea</i>	Cyperaceae	Herbaceous	VU	Pastures
* <i>Centaurea athoa</i> DC.	Asteraceae	Herbaceous	VU	Siliceous slopes
<i>Centaurea odyssei</i> Wagenitz	Asteraceae	Scrub	CR	Calcareous rocks
<i>Cirsium steirolepis</i> Petrak	Asteraceae	Herbaceous	CR	Mountain forest
<i>Crocus gargaricus</i> Herb. subsp. <i>gargaricus</i>	Iridaceae	Bulbous	NT	Grassland, forest
<i>Dianthus anatolicus</i> Boiss.	Caryophyllaceae	Herbaceous	LC	Rocky slopes and pastures
<i>Dianthus arpadianus</i> Ade & Bornm. var. <i>trojanus</i>	Caryophyllaceae	Herbaceous	CR	Calcareous rocks
<i>Dianthus erinaceus</i> Boiss. var. <i>alpinus</i> Boiss.	Caryophyllaceae	Herbaceous	VU	Rocky slopes
* <i>Doronicum austriacum</i> Jacq.	Asteraceae	Herbaceous	VU	Rocky grassland
<i>Euphorbia anacampseros</i> Boiss. var. <i>anacampseros</i>	Euphorbiaceae	Herbaceous	LC	Mountain slopes
<i>Ferulago idaea</i> Ozhatay & E.Akalin	Apiaceae	Herbaceous	CR	Siliceous rocks
<i>Festuca ustulata</i> (Hack. ex St.Yves) Markgr.-Dann.	Poaceae	Herbaceous	EN	Sub-alpine pastures
<i>Hieracium idae</i> (Zahn) Sell & C.West	Asteraceae	Herbaceous	CR	Rocks
<i>Hypericum kazdagense</i> Y.Gemici & E.Leblebici	Clusiaceae	Herbaceous	EN	Siliceous rocks and pastures
<i>Jasione idaea</i> Stoj.	Campanulaceae	Herbaceous	VU	Rocky slopes
<i>Linum boissieri</i> Asch. & Sint. ex Boiss.	Linaceae	Herbaceous	EN	Calcareous rocks
<i>Matthiola trojana</i> Dirmenci, Satıl & Tümen	Brassicaceae	Herbaceous	CR	Calcareous rocks
<i>Minuartia anatolica</i> (Boiss.) Woron var. <i>anatolica</i>	Caryophyllaceae	Herbaceous	LC	Mountain rocks
* <i>Minuartia garckeana</i> (Asch. & Sint. Ex Boiss.) Mattf.	Caryophyllaceae	Herbaceous	CR	Micaceous gravel
<i>Minuartia juressi</i> subsp. <i>asiatica</i>	Caryophyllaceae	Herbaceous	LC	Rocky slopes
<i>Muscari bourgaei</i> Baker	Hyacinthaceae	Bulbous	LC	Calcareous rocks and mountain pas
<i>Nepeta sibthorpii</i> Benth. Subsp. <i>tumeniana</i> Dirmenci	Lamiaceae	Herbaceous	CR	Rocky slopes
<i>Papaver strictum</i> Boiss. & Bal.	Papaceraceae	Herbaceous	NT	Limestone rocks
<i>Paronychia chionaea</i> Boiss. subsp. <i>chionaea</i> var.	Caryophyllaceae	Herbaceous	EN	Rocky slopes
* <i>Paronychia sintenisii</i> Chaudhri	Caryophyllaceae	Herbaceous	CR	Rocky slopes
<i>Picris olympica</i> Boiss.	Asteraceae	Herbaceous	LC	Mountain slopes, alpine pastures
<i>Pterocephalus pinardii</i> Boiss.	Dipsacaceae	Herbaceous	LC	Calcareous mountain slopes
<i>Ranunculus dissectus</i> M.Bieb. subsp. <i>sibthorpii</i>	Ranunculaceae	Rhizomatous	LC	Alpine pastures, limestone rocks
<i>Saponaria chlorifolia</i> Kunze	Caryophyllaceae	Herbaceous	LC	Rocky slopes
* <i>Saxifraga sancta</i> Gris.	Saxifragaceae	Herbaceous	VU	Calcareous peaks
<i>Secale cereale</i> L. var. <i>ancestrale</i> (Zhuk.) Kit Tan	Poaceae	Herbaceous	VU	Calcareous pastures

<i>Sedum lydium</i> Boiss.	Crassulaceae	Succulent	LC	Rock with covered moss
<i>Senecio castagneanus</i> DC.	Asteraceae	Herbaceous	LC	Rocky slopes, forest clearing
<i>Sideritis trojana</i> Bornm.	Lamiaceae	Herbaceous	CR	Calcareous slopes
<i>Silene bolanthoides</i> Quézel , Contandr. &	Caryophyllaceae	Herbaceous	EN	Alpine grassland
<i>Silene sipylea</i> O.Schwarz	Caryophyllaceae	Herbaceous	VU	Calcareous slopes
<i>Stachys cretica</i> L. subsp. <i>smyrnaea</i> Rech.f.	Lamiaceae	Herbaceous	LC	Calcareous rocks
<i>Thymus cherlerioides</i> Vis. var. <i>cherlerioides</i>	Lamiaceae	Scrub	NT	Gravels and rocks
<i>Thymus pulvinatus</i> Celak.	Lamiaceae	Scrub	CR	Calcareous rocks
<i>Thymus sipyleus</i> Boiss. subsp. <i>sipyleus</i> var. <i>sipyleus</i>	Lamiaceae	Scrub	LC	Rocky slopes
<i>Verbascum scamandri</i> Murb.	Scrophulariaceae	Herbaceous	EN	Mountain slopes
<i>Veronica caespitosa</i> Boiss. var. <i>caespitosa</i>	Scrophulariaceae	Woody herb	LC	Calcareous rocks
<i>Veronica elmaliensis</i> M.Fischer	Scrophulariaceae	Herbaceous	NT	Rocky scrubs

Table 2. The number of taxa on the basis of data published in the red list

	Red list categories				
	CR	EN	VU	NT	LC
Endemic	10	10	8	9	18
Non-endemics	2	-	3	-	-

Many endemics show a restricted distribution flourishing only on this mountain, notable among these are *Allium kurtzianum*, *Armeria trojana*, *Asperula sintenisii*, *Astragalus idae*, *Festuca ustulata*, *Hieracium idea*, *Hypericum kazdaghense*, *Jasione idaea*, *Sideritis trojana*, *Ferulago idaea*, *Centaurea odyseii*, *Matthiola trojana*, and *Nepeta sibthorpii* ssp. *tumeniana*. Some rare but non endemic taxa too are found to grow only here in Turkey for example; *Centaurea athoa* and *Saxifraga sancta* (Fig. 3). The economically important medicinal, aromatic and ornamental plants growing around the summit area of Kazdağı are *Armeria trojana*, *Dianthus erinaceus* ssp. *alpina*, *Sideritis trojana*, *Micromeria juliana*, *Salvia tomentosa*, *Stachys cretica* ssp. *smyrnaea*, and *Thymus species* [50].

The critically endangered (CR) taxa like *Achillea fraasii* var. *trojana*, *Centaurea odyseii*, *Ferulago idaea*, *Hieracium idae*, *Matthiola trojana*, *Nepeta sibthorpii* ssp. *tumeniana*, *Sideritis trojana* and *Thymus pulvinatus* are found on narrow fields and restricted habitats (Table 1). Out of these, *Sideritis trojana* (Sarikiz Sage) and *Thymus pulvinatus* (Kazdağı thyme) are overexploited by the public as herbal teas [2,58]. *Sideritis trojana* is widely used by the locals for the treatment of throat-ache and cold. Likewise, *Thymus pulvinatus* “curative thyme” is used as medicinal plant and populations are destroyed by severe collections [4].

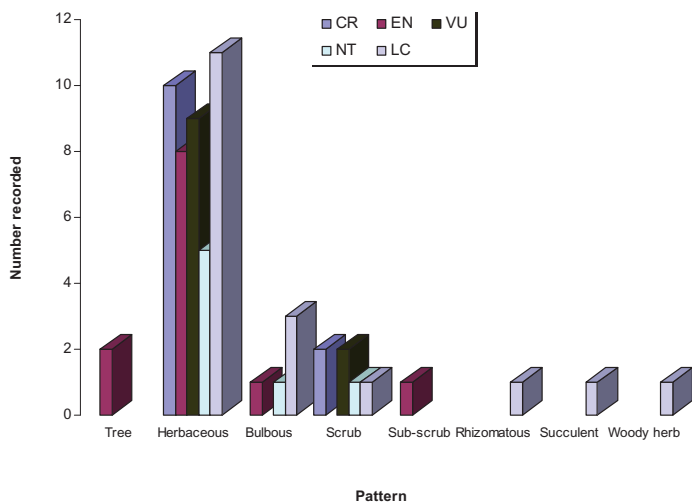


Fig. 4. The plant forms in the study area and their status in the red data book.

The number of plant forms and their risk categories are presented in Fig. 4. Most of the plants (nearly 72 %) collected from the study area are herbaceous. In general one tenth are shrubs, 8 percent bulbous, 3 percent trees and 1.7 percent semi-shrubs, 1.7 percent rhizomatous, 1.7 percent succulents and 1.7 percent woody herbs. Nearly two thirds of herbaceous taxa prefer calcareous rocks, slopes, peaks, pastures, mountain and rocky slopes, forest clearings, and scrub areas. There are 4 CR, 3 NT, 3 VU, 2 LC and 1 EN taxa found on calcareous habitats and 6 LC, 3 CR, 3 VU,

1 EN, and 1 NT on other ones (total 14). Bulbous plants differ from herbaceous, shrubs and semi-shrubs in terms of their places on the red list regardless of their habitat. Although 10 plants are under CR and 9 under VU categories, 11

plants under LC category are among herbaceous plants and 2 under CR and 2 under VU categories are under shrubs and semi-shrubs (Table 1). No bulbous plants were recorded under VU and CR categories, possibly indicating that bulbous plants have more successful adaptive strategies and are more successful against the biotic pressures as well as changing environments on this mountain. Rhizomatous, woody herbs, succulent plants and trees examined were all found to be either not threatened (NT) or come under lower risk (LC).

5. Conclusions

Many papers have been published on the sustainable use of our plant diversity in Turkey [21, 22, 25, 26, 34, 38, 39,40,41,42,43,44,45,46,47,61]. Kazdagi, with its historical past, botanical and ethnobotanical richness is a strong candidate for ecotourism. The mountain is recorded as “Important Plant Area (IPA)” by Planta Europa and WWF. However, several factors are threatening the area such as; summer houses, tourism, expansion of agricultural areas, excessive grazing, collection of wild plants for export, afforestation, fire. Every year in August large number of people come to this mountain during Turkmen Ceremony and most of them collect medicinal, endemic and rare species unconsciously which has adverse affects on the plant diversity [8].

As stressed by Satil et al as [51] well; in order to protect the existing biodiversity there is a need for in-situ protection methods, attempts should be made to bring down the grazing pressures in the area, local people should be involved in this process, voluntary cooperation of the civilian community is very important for success, there is an immediate need for educating residents living close to the in situ preservation area, although this area has been designated as a pilot region, it still requires special protection and support through ex-situ conservation methods. In order to protect the critically endangered (CR) taxa found on narrow fields and restricted habitats, together with the medicinal plants and populations which are destroyed by severe collections, most important step is zonation of Park area and clearcut demarcation of protection zones encircled by buffer zones. There is great need for studies like population ecology of species facing threat and preparation of a computerised data base with regular updating programme. For eco-tourism and celebration of Turkmen festival in an eco-friendly manner footpaths should be constructed for visitors and signs hanged depicting caution measures. The information should be given to the visitors coming to this region and locals educated about the value of rich plant diversity of this area. All this will be successful only if an active participation from local communities and NGO representatives is achieved in this protection programme. The conservation approaches must coincide with changing cultural attitudes that value native species and landscapes as a source of identity and spiritual significance. In the past native landscapes and species were mostly confined to remote situations, but recent decades have seen people protecting native species in their own communities [29]. For this reason, some of the endemic and rare plant species have been transferred for ex-situ conservation to Canakkale Onsekiz Mart University, Rock Garden of Biology Department. Seed bank is being established by making seasonal collections from the wild. There is also a need for the establishment of two centres around siliceous and limestone rocks for in-situ conservation in the area in order to protect their essential floral elements.

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