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An overview of plant diversity of Kazdagi (Mt. Ida) Forest National Park, Turkey

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Abstract: *Kazdagi (Mt. Ida) forms the natural border between the provinces of Canakkale and Balikesir in northwestern Turkey. The highest peak (Karatas Hill) of this mountain is 1774 m. Kazdagi was declared a National Park in 1994 because of its rich plant cover. Its importance is mainly derived from the presence of a restricted zone of Abies nordmanniana ssp. equi-trojani forest as well as for its natural beauty and appearance in classical mythology. There are three vegetation types on Kazdagi, viz. forest vegetation, shrub vegetation and high mountain vegetation. There are 800 plant taxa recorded on Kazdagi. 198 of them are of particular ethnobotanical significance for this mountain. Kazdagi is accepted as one of the most important floristic areas of Turkey.*

Key words: *Plant diversity, Kazdagi forest, National Park, Ethnobotany, Endemism*
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Introduction

Kazdagi occupies an important place in classical mythology. Its name first appears as the Mount Ida in the famous epic poem "The Iliad" composed by Homer in the eighth century B.C. The area around Kazdagi has been under Turkish rule since the thirteenth century A.D. Kazdagi first became a state forest in 1945 and then was declared the 23rd National Park of Turkey in 1994 (Kelkit *et al*., 2005). At present, there are a total of 39 national parks in Turkey, covering an area of 877.777 ha (Anonymous, 2007). Kazdagi forms a natural border between the Marmara and Aegean regions of Turkey, which are phytogeographically located at the transition area of the Euro-Siberian and Mediterranean regions. The summit of Kazdagi is 1774 m high and its highest peaks are Karatas Hill, Father Cilbak, and Sarikiz Peak. It experiences an average annual temperature of 14.8°C, the average annual rainfall is approximately 655.2 mm, and the average number of rainy days is 67.7. The precipitation regime is typical Mediterranean type with rainy winters. The aridity period is between June and September (Koc, 2001). Kazdagi is situated in northwestern Anatolia and is an important natural area, lying between 39° 42' N and 26° 51' E. It is situated in the vicinity of the Gulf of Edremit, forming a natural border between the provinces of Canakkale and Balikesir on the southeast part of the Biga Peninsula in northwestern Turkey (Fig. 1).

In terms of plant coverage, Kazdagi is one of the most important mountains of Turkey. The traditional botanical knowledge of indigenous communities related to the uses and management of wild plant resources is extensive (Celik *et al*., 2008). In this sense, the present study was undertaken for the purpose of investigating the ethnobotanical uses of wild plants in the Kazdagi Forest National Park. The area has also been chosen as a pilot gene management zone as part of the "*in-situ* conservation of plant genetic diversity project" due to its rich plant diversity.

Materials and Methods

The present study was conducted during the period 2000-2003. All specimens collected in the course of field studies were identified with the help of *flora of Turkey and the East Aegean Islands* (Davis, 1965-1985; Davis *et al*., 1988; Guner *et al*., 2000). The collected specimens are currently deposited in the Herbarium of the Faculty of Sciences and Arts at Canakkale Onsekiz Mart University (COMU), numbered under the collector "Uys" (Ismet Uysal). The author abbreviations were scanned in the international plant names index and authors of plant names (Brummitt and Powell, 1992). As part of this study, oral interviews were also conducted with 164 residents from 40 villages on Kazdagi mountain and its environs (Fig. 1). The collecting of ethnobotanical data was completed mainly in and around the rural areas and localities. The collector number, local names, uses, and plant parts used were also recorded.

Results and Discussion

Kazdagi Forest National Park is an important source of plant diversity in terms of agriculture and forestry. The park covers an area of 21.463 ha, out of which 19.781 ha are forest and 1681.5 ha are open space. The forests on the upper slopes consist mainly of Turkish Fir (*Abies nordmanniana* ssp. *equi-trojani*). It was the unique forests of *Abies nordmanniana* ssp. *equi-trojani* that led the Turkish Ministry of Forests to declare Kazdagi, particularly the south side of the mountain, a national park in 1994. Recent studies on the flora and vegetation of this mountain have been carried out by Pamukcuoglu (1976), Gemici *et al*. (1993, 1998), Ozel (1999) and Ozel and Gemici (2001). Approximately 800 vascular plant taxa belonging to 101 families have been recorded from Kazdagi. The high mountain vegetation comprises for four plant communities depending on the rock type, as identified by Ozel and Gemici (2001). In the study of the Kazdagi pseudo-alpine zone undertaken by our

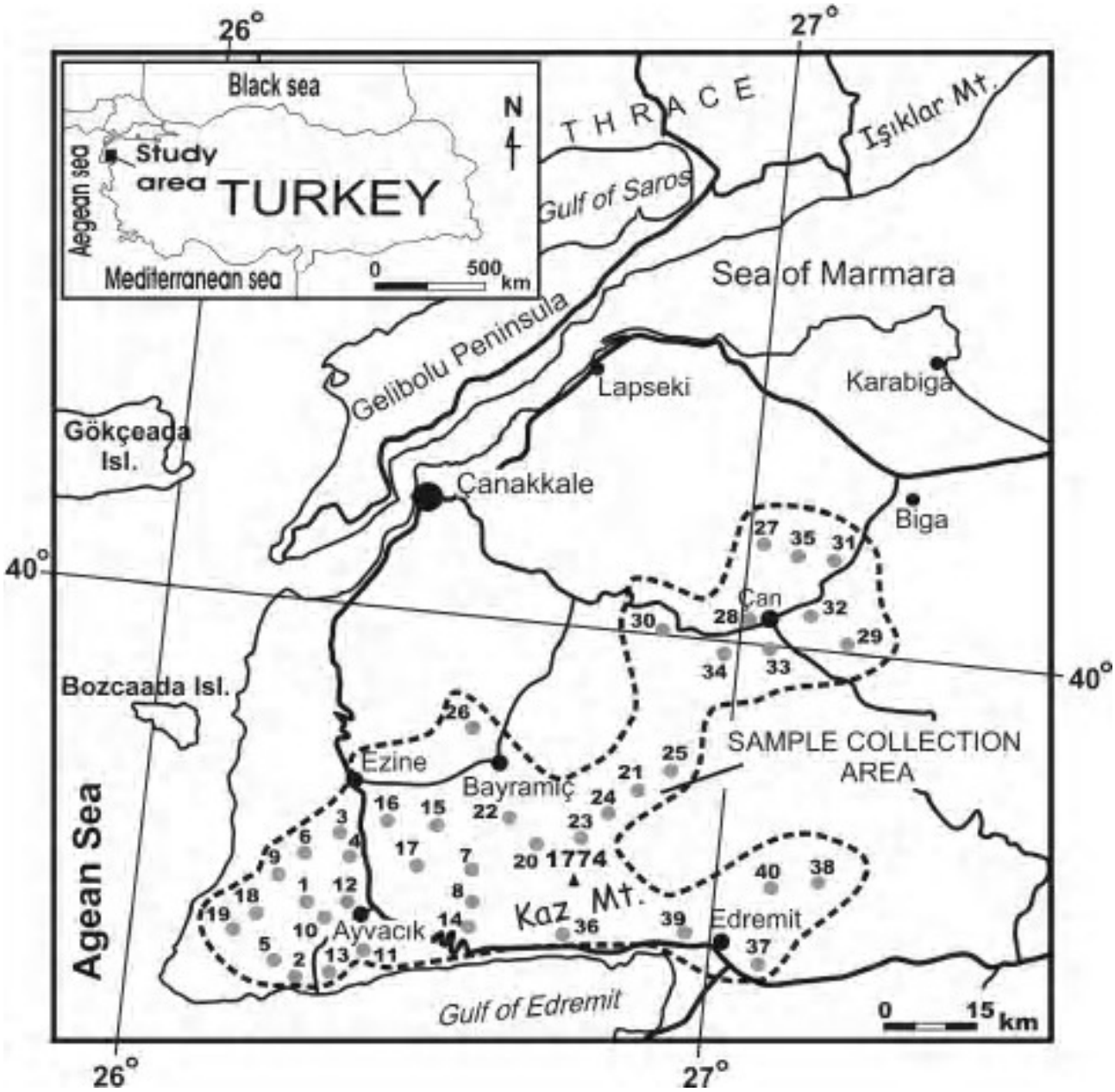

Fig. 1: Map of surveyed area and location of villages (numbered) where information was provided by residents. 1. Ahmetler, 2. Bektas, 3 .Bilaller, 4. Budaklar, 5. Camkabalik, 6. Cakmaklar, 7. Caltikoy, 8. Cetmibasi, 9. Cinarpinar, 10. Erecek, 11. Ilyasfaki, 12. Kecikaya, 13. Korubasi, 14. Kucukkuyu, 15. Misvak, 16. Sapanca, 17. Suleymankoy, 18. Tasbogaz, 19. Tuzla, 20. Cavuslu, 21. Cirpilar, 22. Dagobasi, 23. Evciler, 24. Kulcular, 25. Yesilkoy, 26. Yigitler, 27. Bostandere, 28. Buyuktepekoy, 29. Derenti, 30. Etili, 31. Hacilar, 32. Kalburcu, 33. Karakoca, 34. Terzialan, 35. Yuvalar, 36. Aritas, 37. Derekoy, 38. Kalkim, 39. Kizilkecili, 40. Yasyer

team, 189 specific and intraspecific taxa of vascular plants belonging to 52 families were also recorded (Karabacak *et al*., 2006).

Vegetation communities: Gemici *et al.* (1998) determined three vegetation types in the course of field studies undertaken in the Kazdagi area. These vegetation types are: Forest vegetation (*Pinus brutia* community, *Pinus nigra* ssp. *pallasiana* community, *Abies nordmanniana* ssp. *equi-trojani* community, *Fagus orientalis* community, *Castanea sativa* community, *Carpinus betulus* community, *Quercus* communities); Shrub vegetation (*Phillyrea latifolia* community, *Quercus infectoria* ssp. *boissieri* community); and High Mountain vegetation (*Juniperus communis* ssp. *nana* community, *Astragalus idea* community, *Saxifraga sancta* community, *Narduss stricta* community).

One of the communities of forest vegetation is *Pinus brutia*. This species has its optimum distribution in west and south Anatolia. The southern slopes of the study area are covered by forests of *P. brutia* starting at 800-850 m above sea level. They are also found on the northern slopes reaching up to 400 m. The forests

on the southern slopes have largely been replaced by olive groves.

Another community of forest vegetation is *Pinus nigra* ssp. *pallasiana*. This species is most widely represented in west and northwest Anatolia. Black pine forests start at 800-850 m on the southern slopes of the Kazdagi Mountain, and at 400 m on the northern slopes, but they extend down to 270 m around Kalkim in the northeast. The upper limit of the black pine forest is around 1500 m, with individual trees reaching as high as upto 1550 m. Species of trees and bushes coexisting with black pine are as follows; *Fagus orientalis*, *Castanea sativa*, *Carpinus betulus*, *Quercus cerris* var. *cerris*, *Q*, *petraea* ssp. *iberica* and *Q. frainetto*, *Carpinus betulus*, *Tilia argentea*, *Populus tremula*, *Corylus avellana*, *Sorbus aucuparia*, *Crataegus monogyna*, *Prunus divaricata*, *Juniperus foetidissima*, *Cornus mas*, *Adenocarpus complicatus*, *Genista lydia*, *Salix pedicellata*, *Acer platanoides*, *A. hyrcanum* ssp. *keckianum*, *Platanus orientalis* and *Sorbus torminalis* (Gemici *et al*., 1998).

Abies nordmanniana ssp.*equi-trojani* is another variety of forest vegetation in this area. Gemici *et al*. (1998) found that this community always occupies north-facing slopes. Although individuals descend to 400 m, its optimum distribution is between 1000-1400 m. Most of the time, it is associated with beech (*Fano orientalis*) and black pine. When young, it grows quickly and attains a dominant position. While black pine may take 160 yr to reach 40 cm in diameter, fir reaches the same diameter in only 45 yr; an obvious indication of how fast it grows. *Abies nordmanniana* ssp.*equi-trojani* is found together with the following trees and bushes; *Carpinus betulus*, *Acer platanoides*, *A. campestre*, *Quercus cerris* var. *cerris*, *Q. frainetto*, Q. *petrea* ssp. *iberica*, *Populus tremula*, *Sorbus aucuparia, S. umbellate*, *Castanea sativa*, *Fagus orientalis*, *Pyrola minor*, *P. chlorantha*, and *Crataegus monogyna* (Gemici *et al*., 1998).

The *Fagus orientalis* community is also found among the communities of forest vegetation in the area. It shares almost the same growing area as *Abies nordmanniana* ssp.*equi-trojani*. However, it has a wide distribution. It clearly prefers wetter slopes, shade, and richer soils than the fir. The beech tree, which is distributed at elevations between 600-1400 m, generally exists mixed with the following trees and bushes; *Abies nordmanniana* ssp.*equi-trojani*, *Pinus nigra* ssp. *pallasiana*, *Castanea sativa*, *Carpinus betulus*, *Acer platanoides*, *Quercus cerris* var. *cerris*, *Q. frainetto*, *Taxus baccata*, *Tilia argentea*, *Populus tremula*, *Sorbus domestica, Platanus orientalis*, *Corylus avellana*, and *Sambucus nigra*.

Carpinus betulus is another community of forest vegetation. It was found in mixed communities at the bottom of valleys lying at elevations between 400-650 m in the northern, northeastern and eastern parts of the study area. It is mostly seen mixed with the following species: *Corylus avellana*, *Taxus baccata*, *Quercus cerris* var. *cerris*, *Cornus mas*, *Sorbus aucuparia*, *Malus sylvestris*, *Prunus divaricata*, *Castanea sativa*, *Rosa canina*, *Pinus brutia*, *Fagus orientalis*, *Tilia argentea*, *Ilex aquifolium* and *Ulmus glabra*.

Oak communities, which exist at elevations between nearly 300-1000 m, grow on the southern, eastern, and western slopes which are sunny and relatively dry. Oak generally develops in areas where *Pinus nigra* has been destroyed. In general, *Q. cerris* var. *cerris* and *Q. frainetto* grow in cool places with a Mediterranean climate, which is humid or semi-humid. Generally, three types are dominant: *Quercus cerris* var. *cerris*, *Q*, *petraea* ssp. *iberica* and *Q. frainetto*. Of these, *Q*, *petraea* ssp. *iberica* forms broad seed plantings with *Q. frainetto* between 400-1000 m elevation on the northwest slopes of Agi Dagi, near the town of Can.

In his research entitled "An investigation on the plant geography of Kazdagi", Pamukcuoglu (1976) evaluated the flora of Kazdagi within 5 zones, which are: the shoreline vegetation zone, submediterranean vegetation zone, supermediterranean vegetation zone, alpine vegetation zone, and pseudoalpine vegetation zone. The pseudoalpine zone was evaluated as a high alpine step by Ozel (1999) and Ozel and Gemici (2001). The distribution of ranking the vegetation was determined by climate and soil factors. In this area 7 associations and 2 subassociations belonging to one of these associations were identified by Ozel (1999). These were: *Pinus brutia-Ferulago humilis* association, *Pinus nigra-Digitalis trojana* association, *Fagus orientalis-Rubus caesius* association (*Fagus orientalis* subassociation and *Abies equi-trojani* subassociation), *Castanea sativa-Osmunda regalis* association, *Quercus petraea* ssp. *iberica-Erica arborea* association, *Prunus divaricata-Onopordum anatolicum* association, and *Carpinus betulus-Ulmus glabra* association.

Abies nordmanniana ssp.*equi-trojani* is of an endemic character that grows only on Kazdagi and is in the LR (nt) risk category according to the Red Data Book of Turkish Plants (Ekim *et al*., 2000). Risk categories are grouped into seven classes. LR is for lower risk when a plant species is located in at least five different localities and superior in terms of population (Ekim *et al.,* 2000). LR group has three subclasses based on future situation of plant: conservation dependent (cd), least concern (lc) and near threatened (nt) (Ekim *et al*., 2000). To determine the magnitude and pattern of genetic variation in natural populations of Kazdagi fir, in order to set up in situ reserves of adequate size and number (such as gene management zones), Gulbaba *et al*. (1996) carried out an isozyme study by sampling all possible populations in the Kazdagi area. In another study, genetic differentiation between *Abies nordmannaiana* ssp. *equi-trojani* populations from Kazdagi, and the genetic relationship between Turkish firs belonging to the *Abies nordmannaiana*, was researched. In the interests of protecting genetic biodiversity, it was decided to separate suitable populations into a "Gene Management Zone" (GMZ) in order to study the genetic biodiversity of the determined target species. Thus, the Kazdagi fir on the Kazdagi mountain was accepted as a model area (Velioglu *et al*., 1999). The *in-situ* conservation of plant genetic diversity project, supported by a World Bank Global Environment Facility (GEF) grant, started with survey and inventory studies by the Aegean Forestry Research Institute at Kazdagi mountain in 1994. Gene management Zones (GMZs) of the target species:

Table - 1: List of important plants found in Kazdagi (Mt. Ida) Forest National Park with uses among local population

Scientific name (Collector number)	Local name (Locality number)	Uses	Parts used
Apiaceae			
Conium maculatum L (52)	Kargi, Kasnakotu (27)	Fence-making.	Stem
Eryngium campestre L (2)	Cakir dikeni (6)	Treating kidney illnesses	Stem
Foeniculum vulgare Miller(3)	Erezene, Carsir, arapsaci, dograk, rezene (3,18,21, 27,29,31,33,35,40)	1. Foodstuff. 2. As a cough cure, for improving digestion, preventing gripe in children. 3. Preventing flatulence.	Leaves, stems, flowers, seeds
Asteraceae			
Artemisia absinthium L. (5)	Pelin otu (5)	Diabetes.	Leaves
Helianthus tuberosus L. (6)	Yer elmasi (1)	For making pickles.	Roots
Caryophyllaceae			
Stellaria media (L.) Vill. (27,45)	Kusotu, Cici bici (1,2,3,4,5,6,7,9,19,26,27)	Foodstuff.	Leaves and stem
Cucurbitaceae			
Ecballium elaterium (L.) A. Rich (68)	Aci dulek, karga dulegi(7,9)	1. Sinusitis.2. Hemorrhoids.	Fruits and latex
Fabaceae			
Spartium junceum L.(56)	Katir Timagi (3,12,17,31,33,34)	1. Broom-making 2. Diuretic. 3. Used for dissolving kidney stones, jaundice, and treating asthma, coughs, and bronchitis.	Flowers, branches
Fagaceae			
Quercus infectoria Oliv. ssp. Boissieri (23)	Mese, mese palamudu (1,2,3,4,8,23,24,27,35-40)	1. For painting wool and fibers. 2. As animal food.	Whole plant
Juglandaceae			
Juglans regia L. (31)	Ceviz (1-9,11,18,24, 28,35,39,41)	1. Treatment of bodily fungus. 2. For shining teeth. 3. In cases of poisoning.	Fruits and seeds
Lamiaceae			
Melissa officinalis L. ssp. *altissima (Sm.) Arcongeli.* (36)	Ogul otu, limon cicegi (17,23,24,27)	1. As a spice, for longevity. 2. Useful for migraine. Also for epilepsy, vertigo, nervous attacks and fainting. 3. For keeping bees together in the hive.	Flower buds and leaves
Mentha pulegeum L. (4)	Filiskin (17)	As tea.	Leaves and flowers
Origanum majorona L. (48)	Mercankoosk (3,5,17,23,24,27,28,35)	1. As tea. 2. For chest-pain and stomach-ache. 3. Embolism.	Leaves and Flowers, buds
Sideritis trojana Bornm. (1)	Adacayi, Dag cayi (13)	1. For decreasing body temperature. 2. For relieving throat inflammationand treating chest aches. 3. For improving digestion.	Above-ground
Origanum vulgare L. ssp.*hirta (Link) J.H.letswart* (63)	Guve otu, kekik (1,3,5,6,9,13,14,17,27)	1. As spices. 2. Protecting goods from moths and insects. 3. Preserving dry foods. 4. For appetite-loss. 5. For indigestion problems. 6. For expelling intestinal parasites from body 7. For relieving toothache.	Above-ground
Salvia officinalis L. (26)	Adacayi (1-9)	For throat aches, expelling kidney stones from body.	Leaves
Stachys thirkei C.Koch (37)	Cay (29,31,33)	To regulate blood pressure	Root and flowers
Teucrium chamaedrys L. ssp. *lydium* O. Schwarz (70)	Egzama otu, Mahmut otu (5,9,17)	1. For itches and eczema. 2. Haemorrhoids	Leaves and flowers

Teucrium polium L. (54)	Kisa mahmut otu (17,30,33,34)	For decreasing body temperature and helping to expel urinary bladder stones from body. Provides regular menstruation bleeding.	Leaves and flowers
Thymus longicaulis C. Presl ssp.*chaubardii* (Boiss. and Heldr.ex Reichenb.f.) J.Jalas var.*chaubardii* (62)	Kekik, keklik otu, tas kekigi (1-9,17,26,27, 40)	1. As spices. 2. For constipation. 3. Bronchitis. 4. For flu and hoarse voice.	Stem and leaves
Lauraceae			
Laurus nobilis L. (20)	Defne (17)	1. For headaches. 2. Seasoning for meat dishes	Leaves and seeds
Loranthaceae			
Viscum album L. (82)	Okse otu (20)	Nervine.	Leaves
Malvaceae			
Hibiscus esculentus L. (22,24)	Bamya (1-9)	1. Diabetes. 2. Hypertension. 3. Foodstuff.	Seeds, flowers and fruits
Moraceae			
Ficus carica L. ssp. *carica* (25)	Incir, yemis (1-9)	Treatment of foot-ache.	Leaves and fruits
Myrtaceae			
Myrtus communis L. ssp. *communis* (27)	Mersin (17)	1. Strengthens heart, regulates heart beat. 2. Useful for trembling body parts, paralysis.	Leaves and seeds
Papaveraceae			
Papaver rhoeas L. (13,60)	Gelincik, yabani tere (1,2,3,17,19,22,23, 24,26, 27,36,37)	1. For relieving pain. 2. Regional beliefs.	Stem, leaves and flowers
Plantaginaceae			
Plantago lanceolata L.(72)	Sinirli ot, damarli ot (1,3,7,8)	1. Furuncle and unexposed injuries. 2. Stomach-ache.	Leaves and flowers
Polygonaceae			
Rumex patientia L. (34)	Labada (1,2,3,6,7,17,22,27)	Treatment of diarrhea.	Above-ground
Punicaceae			
Punica granatum L. (44)	Nar (1-9,14)	1. For reducing tension. 2. Useful for heart palpitations.	Flowers and fruits
Portulacaceae			
Portulaca oleraceae L. (51,90)	Semizotu, semizlik (1-9,14,17, 24,27,36,41)	1. Useful in treatment of tumors. 2. Useful in treatment of kidney inflammation and aches.	Stem having leaves
Punicaceae			
Punica granatum L.(44)	Nar (1-9,14)	1. For reducing high blood pressure. 2. Useful for heart palpitations.	Flowers and fruits
Resedaceae			
Reseda lutea L. var. *Lutea* (92)	Muhabbet cicegi (17,18, 35, 39,40)	1. As a dye in carpet-making. 2. As an indoor plant.	Above-ground
Tiliaceae			
Tilia rubra DC. ssp. *caucasica (Rupr.) V. Engler* (124,136)	Ihlamur (1-9,13,14, 17,18,28,37, 40)	1. Foodstuff. 2. For throat aches and coughs, expelling phlegm, and as aid in sweating. 3. As a tranquillizer, for tiredness. 4. Treatment of stomach ulcers. 5. As a seasoning for food.	Leaves and flowers
Urticaceae			
Urtica pilulifera L. (113,128)	Kara isirgan, Isirgan (2,3,26,27,36,40)	1 .Foodstuff. 2. Heart illnesses, cancer, haemorrhoids. 3. Indigestion and stomach illnesses.	Above-ground
Zygophyllaceae			
Tribulus terrestris L. (163)	Coban cokerten (3,5)	For expelling kidney stones from body, to regulate blood pressure.	Leaves

Pinus nigra ssp. *pallasiana*, *Pinus brutia* and *Abies nordmanniana* ssp. *equi-trojani* have been selected. GMZs, areas where plant species possess a rich diversity and are under threat of extinction or are important for economical reasons, are formed in order to maintain genetic diversity and evolution in and between populations. A suitable management plan has been proposed to protect current genetic diversity and to structure the selected GMZs in a sustainable manner where further scientific research studies can be undertaken (Ozel *et al*., 2006).

Ethnobotanical studies: Many plant species of commercial value also grow in the area. Among these, geophytes and medicinal plants are especially important. In addition, aromatic and horticultural plants also grow here. The economically important medicinal, aromatic and ornamental plants growing around the summit area of Kazdagi are: *Armeria trojana, Dianthus erinaceus* ssp. *alpina, Sideritis trojana, Micromeria juliana, Salvia tomentosa, Stachys cretica* ssp. *smyrnaea,* and *Thymus* species. A total of 198 plant taxa belonging to 71 different families were collected in the ethnobotanical study area by the present author (Table 1). The highest number belonged to the family Lamiaceae (23 taxa) followed by Asteraceae (21 taxa) and Apiaceae (13 taxa). Of the other 100 plant taxa, more than two thirds are used medicinally, 33 as foodstuffs, 7 for indoor plant decoration, and 8 for other purposes such as: broom-making, household furniture, animal feed, and dyestuff. In general, 50 plant taxa are being used for multi-purpose benefit. Leaves are the most-used parts and 104 taxa were recorded as used for this purpose (Table 1). The percentage values of other used parts are as follows: stems in 59 taxa, flowers in 45 taxa, fruits in 35 taxa, roots in 23 taxa, seeds in 19 taxa, above-ground parts in 17 taxa, and whole plants in 16 taxa. The majority of the plant taxa are used for medicinal purposes with a much lower percentage as foodstuffs.

The results of this study provide evidence that the ethnobotanical use of plants continues to represent an important asset for health care in rural communities in Turkey. Since mining activities (gold, lead, zinc, *etc.*) have been planned near to the study area, this article might serve as valuable information about the floristic properties of the area. It is recommended that further studies on plant ecology and genetics, and in other fields, should be carried out at Kazdagi in the future.

Endemism and conservation: Although Gemici *et al*. (1993) determined 89 familia belonging to 770 taxa in their first study of the flora on Kazdagi, in their later research on the plant biodiversity of Kazdagi, 101 familia belonging to 800 taxa were detected (Gemici *et al*., 1998). An increase in the members of Gramineae, Leguminosae, Labiatae, Cruciferae and Umbelliferae was observed. The families representing the highest number of taxa include: Compositae (90 taxa), Gramineae (63 taxa), Leguminosae (56 taxa), Labiatae (48 taxa), Cruciferae (39 taxa), Rosaceae (36 taxa), Umbelliferae (31 taxa), Caryophyllaceae (30 taxa), Scrophulariaceae (25 taxa), Liliaceae (24 taxa) and Ranunculaceae (23 taxa). Regarding the specification of the flora elements, the Mediterranean region was the most frequent in this area (24%), while species from the Euro-Siberian made up 17%, and Irano-Turanian region 1.33%. Of the 71 (9%) taxa in the region that are endemic to Turkey, the percentage of endemics at Kazdagi is about 33%.

Kazdagi is the gene centre of the west Anatolian region. Endemic and rare taxa have been preserved on different geological massifs and especially in the pseudo-alpine zone. The endemic species which were found in the Kazdagi pseudo-alpine zone by our team and they are classified in the CR (stands for critically endangered) and EN (stands for endangered) risk category according to the Red Data Book of Turkish Plants (Ekim *et al*., 2000) are: *Achillea fraasii* var. *troiana*, *Allium kurtzianum, Armeria trojana, Asperula sintenisii*, *Bromus spyleus*, *Centaurea odyssei, Cirsium steirolepis*, *Dianthus arpadianus* var. *trojanus*, *Ferulago idaea*, *Festuca ustulata*, *Hieracium idea, Hypericum kazdaghense, Linum boissieri*, *Matthiola trojana, Nepeta sibthorpii* ssp. *tumeniana*, *Paronychia chionaea* var. *latifolia*, *Sideritis trojana, Silene balanthoides*, *Thymus pulvinatus,* and *Verbascum scamandri* (Karabacak *et al*., 2006; Celik *et al*., 2005). Critically endangered (CR) stands for the plants that are considered under an extremely high risk of extinction in the wild in near future (Ekim *et al.,* 2000). Endangered (EN) is used for plants that are considered under with a very high risk of extinction in the wild (Ekim *et al.*, 2000).

Also endemic plants which are grown in Kazdag named *Allium flavum* var. *minus*, *Muscari latifolium*, *Allium sibthorpianum* and *Allium reuterianum* have extinction risk because of causes like fire (Uysal 1992,1999). One of the medicinal and endemic plant species at risk, which is in great demand at open-air markets and is widely consumed, is *Sideritis trojana. S. trojana* (Sarikiz Sage) is collected in this area as a herbal tea and is widely used by the local population for the treatment of sore throat and colds (Uysal *et al*., 1991). *Digitalis trojana* Ivan. is a medical plant which has ethnobotanical importance (Uysal and Ozturk, 1991). These plants are also classified in the EN, VU and LR (lc) risk category according to the Red Data Book of Turkish Plants (Ekim *et al*., 2000). Vulnerable (VU) plants are under high risk of extinction in the wild and, therefore, are not put under EN and CR categories (Ekim *et al*., 2000).

The factors threatening the endemic plants in Turkey are many *viz.* industrialization, urbanization, expansion of agricultural areas, excessive grazing, tourism, collecting wild plants for export, agricultural enterprises and pollution, afforestation, and fire (Ekim *et al*., 2000). To protect existing biodiversity in national parks, endemic species and genetic sources, in-situ protection methods should be used and local people be involved in the process. The voluntary cooperation of the civilian community is very important for success. Residents living close to the declared in-situ preservation area should be educated both in the short and long term.

Under the influence of prevailing northern winds, emitted pollutants from Eastern Europe, the Black Sea, Istanbul, and the Marmara Sea are carried down to the forest. The polluted air (in the form of acid rain) damages the leaves of the forest trees (Karaoz, 1996). The yellow spots recently observed on leaves and the

falling of pine needles one by one in *Abies equi-trojani* forests in the Kazdagi National Park are a result of the acid blight. A great accumulation of sulphur has also been observed on the leaves of Kazdagý trees by Karaoz (1996). Additionally, the coal–fired thermal power station at Can nearby will increase the air pollution proportionately. It is therefore recommended, for preservation purposes, that in-situ reserves be located in at least two populations (Gulbaba *et al*., 1996).

The Kazdagi Mountain, with its historical past and botanical and ethnobotanical richness related to geological, morphological and climatic factors, is a strong candidate for ecotourism in Turkey. However, this requires effective planning of resources, protection of biodiversity, support of local economies, participation and consultation with local communities, development of appropriate staff and responsible marketing. Although Kazdagi has been designated as a pilot region for in situ conservation of genetic diversity in Turkey, supported by the World Bank, it still requires special protection.

The basic principle is to protect the plants' genetic sources via in-situ and ex-situ strategies. The seed samples are conserved in the seed-gene banks of long- and medium-term collections. Furthermore, vegetative materials are also being conserved in the gene banks of research institutes.

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