INTRODUCTION

The “biodiversity hotspots” term is one of the most successful methods developed to preserve the richest and most endangered areas on the world (1). The Mediterranean Basin is one of the most important area for plant diversity (2,3). The plant diversity is excessive, with approximately 30,000 plant species with 13,000 endemics and many of the endemics plants are local (4). The flora of Turkey has approximately 10,000 vascular plants, so it is the richest flora in the temperate zone (5,6). Also, it has special habitats. But, the incomparable flora and habitats of Turkey have been threatened and have diminished rapidly over the last four decades; Turkey has 144 Important Plant Areas (7) which have contributed much to the origin of many cultivated plant species.

The aim of this study is to reveal the biodiversity of the Başkonuş Mountain and to determine alternatives for the protection of the Small Protected Areas (SPAs).

Kahramanmaraş is a region that is comprised of plains in mountains which is located in the South-East Anatolia region of Turkey (8,9) (Figure 1). The flora of Kahramanmaraş is very rich, almost 2500 taxa and many endemic species (20%) (10-16).

ABSTRACT

Objective: The Başkonuş Mountain (Kahramanmaraş) is located in the transition zone of Irano-Turan and Mediterranean plant geographical regions and in the southern part of the Anatolian Diagonal. A specific region in the East Mediterranean basin consists of an area that holds great biological importance and is a world hotspot. In this study, the small protected areas of the Başkonuş Mountain were determined.

Materials and Methods: A total of 17 endemic and 9 rare taxa were selected based on their IUCN statutes, altitudes, and habitats. Their GPS coordinates were loaded on a computer and digitized in a map projection system. Distributions of the selected taxa were marked on a topographic map in the scale of 1/25,000. The 26 maps were overlapped so that the areas of plant biodiversity could be observed on the map.

Results: Six small protected areas were defined on the Başkonuş Mountain. Several threats and conservation suggestions were presented in this study.

Conclusion: Local data about biodiversity sources are limited. Thus, conservation biologists and government offices should play active roles in formal educational settings and employ alternative methods to the community in Kahramanmaraş.

Keywords: Başkonuş Mountain, small protected areas, biodiversity, Turkey
Mountain, Nature Conservation Area, and is in Kahramanmaraş province. The highest point of the examined area is Başkonuş Mountain (1775 m). The research area is located within the Mediterranean phytogeographical region. The three types vegetation basically can be observed in the area are; forest, macchie, and steppe vegetation (13-16).

MATERIALS AND METHODS

Study Area
The study area is located in Kahramanmaraş province. According to Equator 37°38'35''- 37°28'32'' north latitudes, according to Greenwich 36°02'48''- 36°41’54'' east meridians on the topographic map with in scaled to 1/25.000 (Figure 2). This area has a surface area of 203.084 km² (118.258 km² forest, 84.826 km² opened forest) and varies in height from 345 m to the peak of the Başkonuş mountain (1779 m). The Başkonuş Mountain is studied because;

1) Some observations on the vegetation in the Başkonuş Mountain (13-16), and detailed floristic studies in this area during the Project of KANBK (Conservation for Rare and Endemic Plants of Kahramanmaraş and Ardahan was carried out in 2007-2011 and funded by BTC-UNDP (SGP) (10-12).

2) The study area is a promenade area.

Selection of Taxa
The Flora of Başkonuş Mountain consists of 66 endemic taxa (18). In the study, 17 endemic and 9 rare taxa (17 threatened endemic taxa and 9 national threatened rare taxa) were selected according to their IUCN (International Union for Conservation of Nature) statutes (19), altitudes and habitats as listed in Table 1. Endemic which includes endemic taxa found solely in Kahramanmaraş and in neighbouring areas (e.g., Ahır Mountain, Binboğa Mountain, Çimen Mountain) (13-16).

Field Investigations
The field work was carried out in 2011 and information of various data such as GPS (Global Positioning System), altitude, habitat, density of plant population and selected taxa for each 10 km, were recorded. Some newly recorded plants for the Flora of Başkonuş Mountain were collected during the field studies; the plants were identified and kept in ISTE (The Herbarium of Istanbul University Faculty of Pharmacy).

In this study, 13 habitats types were defined and presented in a simplified list as Table 2, where the endemics and rare taxa of Başkonuş Mountain grow. The numbers of endemic and rare plants in the habitats were presented by a chart. Additionally altitudinal distributions of the selected taxa were showed with a chart. During the field work, 610 GPS were loaded on the computer and digitized in Map Projection System; ED 1950 UTM Zone 37 N which is a GIS program (Geographic Information Systems). Distributions of the selected taxa were marked on the topographic map in scaled to 1/25.000. Afterwards the 26 maps were overlapped so that the areas of plant biodiversity were occurred on the last map could be seen on Figure 3. As the results of there, six SPAs were defined in Başkonuş Mountain.

RESULTS

The results identified six sites which were based on one or more of the following criteria: 1. Presence of rare species, 2. Presence of botanical diversity, 3. Presence of threatened habitats. The six determined SPAs were described using altitudes, size (km²), habitats, selected taxa and other plants. Descriptions of the SPAs were presented in Table 3.

Habitat Types and Altitude Differentiation
Habitat types were grouped as rocks, grasslands, meadows, shrubs, woods, cultivated area, waste and then 13 habitats types were defined. Pinus brutia, P. nigra, Cedrus libani, Abies cilicica, Taxus baccata, Alnus glutinosa are the main taxa of forest vegetation. Additionally Quercus cocciifera, Styrax officinalis, Arbutus unedo, Pistacia terebinthus and Cotinus coggyria are the main taxa of shrubby vegetation.

Some endemics and rare plants have been found in several different habitats, these being: Lathyrus laxiflorus subsp. angustifolius, Helleborus vesicarius –in shrubs, screes, cliffs and rocks. Some endemics have been found only in special habitats,
these being: *Allium glutaceum*- in screes, *Fritillaria alfredae*- in shrubs.

The relationship between the selected taxa and altitudinal zones has been reported (Figure 3). The endemics and rare plants of Başkonuş Mountain develop densely in 1200-1400 m and in 600-1000 m. Ziyaret Hill has maximum habitats although it is the smallest SPA. Its altitude zone and the richness of the habitat provide a

<table>
<thead>
<tr>
<th>Taxa</th>
<th>IUCN</th>
<th>Altitudes</th>
<th>Habitats</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acer monspessulanum</em> L. subsp. <em>oksalianum</em> Yalt.</td>
<td>VU</td>
<td>1000-1200</td>
<td>W3, R3, S2</td>
</tr>
<tr>
<td><em>Allium glutaceum</em> Boiss. &amp; Hausskn.</td>
<td>LR (cd)</td>
<td>1500-2200</td>
<td>R2</td>
</tr>
<tr>
<td><em>Astragalus distinctissimus</em> Eig</td>
<td>EN</td>
<td>1200-1520</td>
<td>W1</td>
</tr>
<tr>
<td><em>Astragalus leporinus</em> Boiss. var. <em>hirsutus</em> (Post) D.F.Chamb.</td>
<td>LR (lc)</td>
<td>600-1500</td>
<td>W2, C1</td>
</tr>
<tr>
<td><em>Centaurea lycopifolia</em> Boiss. &amp; Kotschy</td>
<td>LR (nt)</td>
<td>50-2000</td>
<td>R1, S1</td>
</tr>
<tr>
<td><em>Colchicum davisi</em> C.D. Brickell</td>
<td>EN</td>
<td>1000-1950</td>
<td>R2, G1</td>
</tr>
<tr>
<td><em>Crataegus aronia</em> (L.) Bosc. ex DC. var. minuta Browicz</td>
<td>LR (lc)</td>
<td>600-1300</td>
<td>G1</td>
</tr>
<tr>
<td><em>Cyclamen pseudoibericum</em> Hildebr.</td>
<td>EN</td>
<td>550-1500</td>
<td>G1, W1, W2, W3</td>
</tr>
<tr>
<td><em>Fritillaria alfredae</em> Post subsp. <em>glaucoviridis</em> (Turrill) Rix</td>
<td>VU</td>
<td>500-1600</td>
<td>S1</td>
</tr>
<tr>
<td><em>Helleborus vesicarius</em> Aucher</td>
<td>LR (nt)</td>
<td>550-1300</td>
<td>S1, W4, G2</td>
</tr>
<tr>
<td><em>Kitaibelia balansae</em> Boiss.</td>
<td>EN</td>
<td>1900-2000</td>
<td>R1, G1, C2</td>
</tr>
<tr>
<td><em>Lathyrus laxiflorus</em> (Desf.) Kuzntze subsp.<em>angustifolius</em> (Post ex Dinsm.) P.H.Davis</td>
<td>VU</td>
<td>1200-1400</td>
<td>R1, S1, W3</td>
</tr>
<tr>
<td><em>Michauxia tchihatchewii</em> Fisch. et Mey.</td>
<td>LR (nt)</td>
<td>500-1800</td>
<td>R1</td>
</tr>
<tr>
<td><em>Rhamnus nitidus</em> P.H.Davis</td>
<td>LR (cd)</td>
<td>700-1300</td>
<td>W1</td>
</tr>
<tr>
<td><em>Verbascum amanum</em> Boiss.</td>
<td>VU</td>
<td>400-2000</td>
<td>R1, S1, W1</td>
</tr>
<tr>
<td><em>Verbascum pinetorum</em> (Boiss.) Kuntze</td>
<td>VU</td>
<td>370-1000</td>
<td>S1, W1</td>
</tr>
<tr>
<td><em>Hyacinthus orientalis</em> L. subsp. <em>chionophilus</em> Wendelbo</td>
<td>LR (nt)</td>
<td>1900-2000</td>
<td>R1, R3, G1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Taxa</th>
<th>IUCN</th>
<th>Altitudes</th>
<th>Habitats</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Anemone blanda</em> Schott &amp; Kotschy</td>
<td>VU</td>
<td>150-2600</td>
<td>R1, S1</td>
</tr>
<tr>
<td><em>Allium opacum</em> Rech. fil.</td>
<td>EN</td>
<td>800-1700</td>
<td>R1, R2</td>
</tr>
<tr>
<td><em>Allium dodecanasii</em> Karavokyrou &amp; Tzanoud.</td>
<td>EN</td>
<td>400-1000</td>
<td>R3, W1</td>
</tr>
<tr>
<td><em>Anacamptis pyramidalis</em> (L.) Rich.</td>
<td>LR (lc)</td>
<td>200-1500</td>
<td>W4,G1, C1, C2</td>
</tr>
<tr>
<td><em>Cephalanthera rubra</em> (L.) Rich.</td>
<td>LR (lc)</td>
<td>200-1500</td>
<td>W1, W2, S1</td>
</tr>
<tr>
<td><em>Comperia comperiana</em> (Steven) Asch. &amp; Graebn.</td>
<td>EN</td>
<td>500-1600</td>
<td>W1, W2, W3</td>
</tr>
<tr>
<td><em>Epipactis condensata</em> Boiss.</td>
<td>LR (lc)</td>
<td>600-1600</td>
<td>W1</td>
</tr>
<tr>
<td><em>Eranthis hyemalis</em> (L.) Salisb.</td>
<td>VU</td>
<td>1300-1800</td>
<td>G2</td>
</tr>
<tr>
<td><em>Lathyrus variabilis</em> (Boiss. &amp; Ky.) Maly</td>
<td>VU</td>
<td>1000-1700</td>
<td>R1, S1, W3</td>
</tr>
</tbody>
</table>

high level biodiversity, so the smallest size SPA competes with the largest size SPA (Locality of Yediardıç) about in number of contained endemic and rare taxa.

**Endemism**
The flora of Başkonuş Mountain has 565 taxa of which 66 are endemics with an overall endemism of 11.68%. According distributions of the selected endemic and rare taxa, Small Protected Area 2 (Locality of Yediardıç) has the highest number of selected endemic and rare taxa (Figure 4). Firstly, the selected endemic and rare plants were found in a woody habitat (W1 and W4) with a rate of 29.01%. Secondly, they were found in a rock habitat (R1 and R3) with a rate of 20.85% (Figure 5).

**Threats and Conservation State**
The main factor responsible for the threats to plants in the Başkonuş Mountain is human pressure. Intensive grazing of sheep and goats in the meadows and grasslands, uncontrolled plant collection, especially some orchids (Anacamptis pyrimidalis, Comperia comperiana), and working on road and forestry activities (uncontrolled tree cutting or silviculture) are the most important threats to the flora of Başkonuş Mountain. According to IUCN categories, 7 taxa is EN (endangered), 8 taxa is VU (vulnerable), 4 taxa is LR (nt) (near threatened), 2 taxa is LR (cd) (conservation dependent) and 5 taxa is LR (lc). The endangered and vulnerable taxa are distributed in the second SPA (Figure 6). This is not surprising due to the fact that the most numerous endemic taxa observed are in this area.

The Başkonuş Mountain has various types of rock slides and screes. This habitat is a biotope of most numerous endemic geophytes (Allium glumaceum, Colchicum davisi, Fritillaria alfredae subsp. glaucoviridis, Cyclamen pseudoibericum, Hyacinthus orientalis subsp. chionophilus).

**DISCUSSION**
Başkonuş Mountain has specific habitat such as medium-height steep slopes and forest edges. This habitat is also a refuge for endemics. Habitat loss is thought to lead to endemic species extinctions. Many studies use species-area relationships and predict substantial extinctions when levels of habitat loss exceed approximately 70-80% (16).
### Table 3. Descriptions of the Small Protected Areas

<table>
<thead>
<tr>
<th>SPA 1: Tower of fire observation and around</th>
<th>SPA 2: Locality of Yediardic</th>
<th>SPA 3: Pond and Castle Around</th>
<th>SPA 4: Ziyaret Hill</th>
<th>SPA 5: Locality of Rahmacılar</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coordination:</strong> 37°33'00&quot;N 36°35'00&quot;E</td>
<td><strong>Coordination:</strong> 37°34'00&quot;N 36°35.5'00&quot;E</td>
<td><strong>Coordination:</strong> 37°34.5'00&quot;N 36°35'00&quot;E</td>
<td><strong>Coordination:</strong> 37°34.5'00&quot;N 36°35'00&quot;E</td>
<td><strong>Coordination:</strong> 37°33'00&quot;N 36°35.5'00&quot;E</td>
</tr>
<tr>
<td><strong>Size:</strong> 0.5 km²</td>
<td><strong>Size:</strong> 1 km²</td>
<td><strong>Size:</strong> 0.83 km²</td>
<td><strong>Size:</strong> 0.4 km²</td>
<td><strong>Size:</strong> 0.7 km²</td>
</tr>
<tr>
<td><strong>Altitude:</strong> 1700-1800 m</td>
<td><strong>Altitude:</strong> 1400-1500 m</td>
<td><strong>Altitude:</strong> 1300-1400 m</td>
<td><strong>Altitude:</strong> 1200-1300 m</td>
<td><strong>Altitude:</strong> 1200-1300 m</td>
</tr>
<tr>
<td><strong>Habitat types:</strong> Cliffs and rocks, screes, calcareous rocky grasslands, alpine grasslands, snowbeds and needle leaved forest</td>
<td><strong>Habitat types:</strong> Forest, shrubby places, screes and alpine grasslands</td>
<td><strong>Habitat types:</strong> Cliffs and rocks, moist rocks, river bed shrubs, forest</td>
<td><strong>Habitat types:</strong> Cliffs and rocks, moist rocks, river bed shrubs, alpine grasslands, forest</td>
<td><strong>Habitat types:</strong> Cliffs and rocks, alpine grasslands</td>
</tr>
<tr>
<td><strong>Threatened endemic taxa:</strong> Centaurea lycopifolia, Colchicum davisi, Crataegus aronia var. minuta, Cyclamen pseudoibericum, Helleborus vesicarius, Lathyrus laxiflorus subsp. angustifolius, Verbascum amanum, Verbascum pinetorum</td>
<td><strong>Threatened endemic taxa:</strong> Acer monspessulanum subsp. oksalianum, Allium glumaceum, Astragalus distinctissimus, Astragalus leporinus var. hirsutus, Centaurea lycopifolia, Colchicum davisi, Crataegus aronia var. minuta, Cyclamen pseudoibericum, Fritillaria alfredae subsp. glaucoviridis, Helleborus vesicarius, Lathyrus laxiflorus subsp. angustifolius, Rhamnus nitidus, Verbascum amanum, Verbascum pinetorum</td>
<td><strong>Threatened endemic taxa:</strong> Acer monspessulanum subsp. oksalianum, Allium glumaceum, Astragalus distinctissimus, Centaurea lycopifolia, Crataegus aronia var. minuta, Cyclamen pseudoibericum, Fritillaria alfredae subsp. glaucoviridis, Helleborus vesicarius, Kitaibelia balansae, Lathyrus laxiflorus subsp. angustifolius, Verbascum amanum, Verbascum pinetorum</td>
<td><strong>Threatened endemic taxa:</strong> Acer monspessulanum subsp. oksalianum, Astragalus distinctissimus, Centaurea lycopifolia, Crataegus aronia var. minuta, Fritillaria alfredae subsp. glaucoviridis, Helleborus vesicarius, Lathyrus laxiflorus subsp. angustifolius, Rhamnus nitidus, Verbascum amanum, Verbascum pinetorum</td>
<td><strong>Threatened endemic taxa:</strong> Comperia comperiana, Lathyrus variabilis, Eranthis hyemalis</td>
</tr>
<tr>
<td><strong>Threatened rare taxa:</strong> Allium opacum, Anemone blanda</td>
<td><strong>Threatened rare taxa:</strong> Anemone blanda, Cephalanthera rubra, Comperia comperiana, Lathyrus variabilis, Anacamptis pyramidalis, Epipactis condensata</td>
<td><strong>Threatened rare taxa:</strong> Cephalanthera rubra, Comperia comperiana, Lathyrus variabilis, Eranthis hyemalis</td>
<td><strong>Threatened rare taxa:</strong> Comperia comperiana, Lathyrus variabilis, Epipactis condensata</td>
<td><strong>Threatened rare taxa:</strong> Uncontrolled grazing and plant collection, human pressure</td>
</tr>
<tr>
<td><strong>Threats:</strong> Working on forest road, uncontrolled tree cutting, and plant collection.</td>
<td><strong>Threats:</strong> human pressure, uncontrolled grazing, and construction</td>
<td><strong>Threats:</strong> Working on highway, uncontrolled grazing, and plant collection.</td>
<td><strong>Threats:</strong> Uncontrolled grazing and plant collection, human pressure</td>
<td><strong>Threats:</strong></td>
</tr>
</tbody>
</table>
Table 3. Descriptions of the Small Protected Areas (Continue)

<table>
<thead>
<tr>
<th>Habitat types:</th>
<th>Shrubby places and forest</th>
</tr>
</thead>
</table>

**Threatened endemic taxa:**
- Acer monspessulanum subsp. oksalianum
- Allium glumaceum
- Centaurea lycopifolia
- Crataegus aronia var. minuta
- Cyclamen pseudoibericum
- Fritillaria alfredae subsp. glaucoviridis
- Helleborus vesicarius
- Hyacinthus orientalis subsp. chionophilus
- Lathyrus laxiflorus subsp. angustifolius
- Rhamnus nitidus
- Verbascum amanum

**Threatened rare taxa:**
- Anemone blanda
- Lathyrus variabilis

**Threats:**
- Working on road, uncontrolled plant collection, human pressure,

**SPA 6: Locality of Topcalı and Sersem**

**Coordination:** 37°33’00”N 36°35.5’00”E  
**Size:** 0.79km²  
**Altitude:** 1300-1400 m

<table>
<thead>
<tr>
<th>Habitat types:</th>
<th>Shrubby places, alpine grasslands, snowbeds, scree and forest</th>
</tr>
</thead>
</table>

**Threatened endemic taxa:**
- Acer monspessulanum subsp. oksalianum
- Allium glumaceum
- Centaurea lycopifolia
- Crataegus aronia var. minuta
- Helleborus vesicarius
- Lathyrus laxiflorus subsp. angustifolius
- Michauxia tchihatchewii
- Rhamnus nitidus
- Verbascum amanum

**Threatened rare taxa:**
- Allium dodecanesii
- Epipactis condensata
- Lathyrus variabilis

**Threats:**
- Opening agricultural area, working on road, uncontrolled plant collection, human pressure,
Selected endemic taxa which include endemic plants found only in Kahramanmaraş and in neighbouring areas (e.g., Ahır, Binboğa, Çimen Mountains) (17-20). In fact most endemism grow in high stress level populations, such as screes (R2), cliffs and rocks high and mid altitude (R1) and alpine grasslands (G2) (16,21), but it should be emphasized that endemics and rare plants are found in woody habitats, especially coniferous habitats in the study.

The flora of the Başkonuş Mountain is comparable with data from the literature for mountainous areas in the Mediterranean recognized as one of the most important centers of endemism on Earth (22,23). Besides, the relationship is considered biodiversity, habitats and endemic plants is remarkable compared to other Mediterranean hotspots (24-26). For example, although the Başkonuş Mountain has a smaller area than the Alps and the Pyrenees, its endemism rate is higher than them. Additionally, the ratio of endemic species per unit area is higher than Pyrenees and the Andalucía Mountains could be seen on Table 4.

Ecologists recognize that the Earth’s biota is now experiencing the sixth great extinction wave (27). The conversion of native forest and grasslands, to plantation crops is one of the largest threats to terrestrial biodiversity and a key of the global extinction crisis (28). Additionally, intensive grazing causes transformation of the vegetation in scrub communities and in the woods (21).

While people have become more aware of environmental problems recently, most do not get actively involved in movements that support a more liveable future (3). Many people reach limited data about biodiversity issues from sources that may be biased. Thus conservation biologists and government offices should be much more active in formal educational settings and via alternative methods to a diversity of audiences in Kahramanmaraş.

An agreement among politicians and managers of the local administrations and parks (City Councils, Government and National Parks) is necessary in Kahramanmaraş and Turkey.

Major threats to biodiversity include human-associated factors, such as habitat destruction and degradation, over profiteering, invasive species, incidental mortality, pollution, climate change diseases and human population growth (31).

**CONCLUSION**

Six SPAs were defined in Başkonuş Mountain. Some threats and conservation suggestions were presented in this study. Local people reach limited information about biodiversity issues from sources that may be biased. Thus conservation biologists and government offices should be much more active in formal educational settings and via alternative methods to a diversity of audiences in Kahramanmaraş.

**Peer-review:** Externally peer-reviewed.


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