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Observations on the Floristic List of the Mersin Collected from the Highplateaus of Mersin

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ABSTRACT

Mersin University Research Herbarium (MERA) plants which are collected from Middle Taurus mountains are part of the Alpin-Himalayan system. In this research, the importance of these plants in terms of endemism and rare specimens is emphasized and they are compared with some of the Alpin and Himalayan plants.
MERA is presented for the first time. The 5000 sheets of specimens were collected between 1996-2009. Our results indicate that Asteraceae, Lamiaceae, Fabaceae, Poaceae are common families collected from the highplateaus in Gülnar, Bozyazı, Mut, Erdemli, Çamlıyayla and Tarsus province of Mersin.

INTRODUCTION

Figure 1. The Geographical Position of Research Area

Mersin is a city in the south of Turkey (Figure 1).

Turkiye, as a whole, houses more than 10 000 species of Spermatophyta, whose 33.3 (%) is endemics and which has many different types of vegetation. In Medditerenean Region, the Taurus Mountains support a high level of biodiversity, including a large number of endemic plants. Some 1710 of these endemics occur in the Bolkar Mountains in the middle of the Taurus range (Gemici 1994). *Astragalus, Verbascum, Centaurea, Galium, Alyssum, Stachys, Allium, Bupleurum, Tanacetum, Campanula, Anthemis, Silene, Arenaria, Sideritis, Salvia, Scrophularia, Alkanna, Crocus, Thlaspi, Veronica, Trigonella, Lathyrus, Onosma, Paracaryum, Crocus, Hieracium, Achillea, Hypericum, Fritillaria, Aethionema, Hyacinthella, Aristolochia, Pholomis, Nepeta, Thymus* are main endemic genera in Mersin (Babaç *et al* 1997).

There are a number of floristic and vegetation studies on the research area which covers the vegetation of Mut-Ermenek (Vural 1981), flora of Taşeli plateau (Sümbül and Erik 1988 a,b; 1990 a,b) and the flora of Bolkar mountains (Çamlıyayla, Gözne, Aslanköy highplateaus) (Gemici 1994). When we consider all of the researches, the most prevalent families contained in these researches are respectively, Asteraceae, Fabaceae, Lamiaceae, Brassicaceae, Poaceae, Caryophyllaceae, Apiaceae, Scrophulariaceae, Boraginaceae, Rosaceae, Liliaceae and Rubiaceae. These materials collected are housed in EGE, GAZI, ANK and AKDU.

Over 250 million plant specimens exist in more than 3000 herbaria in over 150 countries. Of all those specimens, only a small percentage has been inventoried and even a smaller percentage of these is avaliable online (Krupnick *et al* 2008). MERA was established in 1996 and now 4931 vascular plants and 500 Cryptogamae is preserved there. These plants belong to C4-C5 grid area.

Geology and History

Caves dating from 570 million years ago in Mersin (Aydıncık and Silifke) provide a definite evidence for the expansion of the Taurus Mountains during the late Miocene period. The range of mountains such as those of Bolkar, Aladağ and Geyik emerged from the Mediterranean sea as a result of tectonic pressure. Today, the Taurus Mountains are still in motion (Demirtaşlı *et al* 1975, Ünal *et al* 2001). Various kinds of marine fossils can be found on all of the high plateaus, but fossils of freshwater forms, eg. crocodile appear in some areas of Dalakderesi, Avkadı and Mut. Year by year, vertical tectonic movement in the Taurus Mountains has given rise to rich karstic formations. Canyons like Göksu were cut by giant rivers. Some of the important canyons such as Çömelek, Sason, Kubat and Kestel can reach up to almost 100m depth. Also, other important valleys are Cocak, Cacık and Göksu valleys.

Such valleys developed owing to the rise of the entire Taurus range from the sea, their rivers carved their beds early in the Quarternary period. Sometimes it is possible to estimate the depth of these rivers by investigating the cuts they have through the rock. In Mut, the Göksu river has cut a depth of 1000m, and the Cocak near Cehennemdere,

to a depth of 1500m through the Dümbelek Plateau (Atalay 1994).

The typical formation of the Taurus mountains are Miocene sediments with clay, marn and limestones derived from the sea.

Series of caves appear at 1000meters in various localities, including Çamlıyayla and Kozlar. In the Tertiary period, a tropical climate allowed the growth of *Pistacia, Quercus, Olea* and *Cistus*. Also in present, *Taxodium distichum* and *Liquidamber orientalis*, continue to flourish as plantation trees in Tarsus, Karabucak. A change to a colder climate occurred in the Quarternery period, as indicated by the arrival of *Carpinus orientalis*, *Cornus sanquinea* and *Taxus baccata* (Çamlıyayla) in the Mediterranean Region (Seçmen 1996).

The forest trees in Mersin highplateaus

Pinus brutia is widespread in Mersin. Also, the high plateaus have *P. nigra* in high level. Aslanköy, Abanoz, Güzeloluk, Bozyazı high plateaus, support the oldest forest of *Pinus brutia*. In the southern area, *Cedrus libani* has been living for a long time together with species of *P. nigra.*

In the region, the different forest trees include *Pinus brutia*, Junipers, *Pinus nigra* var *caramanica* (eg. in Mut), *Abies cilicica* (eg. in Ayvagediği: Karatepe), *Cedrus libani* (eg. in Mersin: Avgadı, Abanoz) and oaks. Differing from the other highplateaux, the maquis species, together with broad leaved forest species *Acer* and *Fraxinus* form a pseudomaquis in Fındıkpınarı.

On the grazed slopes in the steppe sector, at altitudes around 2000meters, *Juniperus excelsa, J. foeditissima* are common. Generally, garique vegetation is common in the arid and damaged areas, at 50-100meters, typically including *Sarcopoterium spinosum, Cistus salvifolius, C. creticus* and *Thymus cilicicus.*

Quercus coccifera, with the shrub habitat, form the important microhabitats of the high plateaus in the Mediterranean region. *Q. coccifera* generates new forests and conserves the soil. Oaks on the Mersin highplateaus (Davis, 1985) including *Quercus cerris, Q. ithaburensis, Q. robur, Q. infectoria, Q. petrae, Q. coccifera* appear on all of the highplateaus. Among these, *Q. infectoria* appear at ca. 500m., in Güzeloluk and Balandız, *Q. ithaburensis* at ca. 800-900m in Balandız, Gülnar, Uzuncaburç and Kırobası, *Q. trojana* at 1000m in Mut, and *Q. cerris* at about 1000m in Aslanköy, Çamlıyayla, Gökbelen, Gülnar, Kırobası and Güzeloluk; and Q. *petrae* is observed as dispersed trees in the all of the highplateaus.

The relationship of the people to the forests

The people of the high plateaus engage in animal breeding, agriculture and forestry. The microclimate zones allow the growth of oranges, kiwi and *Diospyros kaki* fruits and various vegetables, such as in Aslanköy, Sutras.

Grazing is particularly prevalent on the alpine slopes because it is a traditional practice in the world. The herdsmen reach the different alpine zones from the middle of March to September and during this period most of the young plants are eliminated from these areas because of premature grazing. The nomadic people live in stone shelters or tents “çadır” , just like “yurt ” in Kyrgyz , while their flocks seek the cover of oak trees. Sometimes, owing to the climate or the need for veterinary attention, the flocks will be brought down the mountain for a short time.

It seems that, in undisturbed areas, some of the shrubs which grow in open areas can become to form tall trees, for example, *Q. coccifera* in Aslanköy and Çamlıyayla. Against destroying forests, one of the preventive plans by the Forest Ministery is to increase the number of nursery-gardens (Baki *et al* 1998). Also, in the last years, different “memory forests” are developed by the Forest Ministry and tracking activities, trips and camping facilites are organised. One of the tracking centres is Medetsiz summit (3524 m) in the Bolkar Mountains.

Also, these areas of biodiversity are conserved by the General Directorate of Ministry of Forestry (Orman Genel Müdürlüğü 1999): Conservation area of the wild goats of Çağlarca and Gökbelen: Hisardağ Karakaya-Göksu, Cocak-Cehennemdere and Mut: Alahan, Kestel, Göksu Delta Conservation area, Conservation area of the Perdix perdix: Anamur: Kızılaliler, Sarıaliler, Sarıyayla Conservation area of Capreolus capreolus: Anamur: Sugözü.

Erdemli pine plantations, the Alata research center, Hundreth century Conservation Park, City Forest and Kayacı valley are famous recreation centres in Mersin. Also, Gülek, Karboğaz area in Mersin was reorganized for turism in 2008. It is clear that the original forest cover (red pines, oaks, fir, junipers, cedar) has existed from the ancient geological periods to the present day. In ancient times, the felling of timber for foreign export has destroyed much of the vegetation in Mersin than in Adana.

MATERIALS AND METHODS

In this research, in general the observations of the collected plants from Mersin highplateaus (Middle Taurus Mountains) is presented. These plants are housed in MERA in Biology Department. The plant species were identified according to Davis (1985) and Güner *et al* (2000).

The climate is generally Mediterranean, with hot summers and mild winters (Met. gen. bull. 1974). The Taurus Mountain range tends to have wet winters and dry summers, with an average annual rainfall of 750-1350 mm. Most of the total rainfall in the mountains occurs as snow in winter or smog (in summer and winter). Within this general pattern of rainfall there are wide local variations. The alpine level has a slightly terrestrial climate. Rainfall is surely the most important factor after altitude as an influence on the composition of the high plateaus flora. In both

winter and summer, the research area experiences long hours of daylight.

Research area

Mersin contains about 64 high plateaus. High plateaus is known as 'yayla' in Turkey. They have many visitors in Summer, but in winter they are generally populated only by local people. In spring, the people like to move from their villages to the high steppe areas. The names of some localities in the highplateau reflect the nature of their vegetation. Examples include Daffodil Mount, Pine Valley, Yellow Water, etc. Additionally, names like Red Mountain, Red Area, Red Vineyard refer to the colour of the Mediterranean soil.

The research area is in the Mediterranean region of Turkey and extends westward from the Taşeli plateau to Ceyhan River, and northward, from the coast to the middle Taurus Mountains. The phytogeography of Mersin is influenced by Bolkar and Geyik Mountains. Several wetlands, such as Bakır, Göksu, Lamas, Deliçay and Berdan which contain many significant migration routes of birds, play an important role in the ecological stability of southern Turkey. Furthermore, Mediterranean, Irano-Turanien and relic Euro-Siberian elements grow in the research area (Figure 1). In this area, especially the riversides of Anamur, Bakır, Göksu, Lamas, Berdan and Deliçay contain new recorded plants such as *Flueggea anatolica* from Berdan riversides in Çamlıyayla; Yalamık village (Gemici 1994) and *Jurinea cyprea* in Göksu riversides.

Mersin Highplateaux

Tarsus: Gülek, Namrun (Çamlıyayla) (1500 m), Sebil, Hangediği,
Mersin: Gözne, Soğucak (800 m), Ayvagediği (1500 m), Kızılbag, Fındıkpınarı (1100 m), Aslanköy (1350 m), Mihrican, Haçgediği,
Erdemli: Avgadı (900 m), Güzeloluk (1100 m), Sorgun (1600 m), Dedeli (2000 m); Küçükfındık, Toros (1600 m), Hacıalanı, Pınarbaşı, Güneyli,
Silifke: Balandız (900 m), Gökbelen, Çaltız,
Gülnar: Bardat (1450 m),Tersakan, Ilısulu, Bozyazı: Kozağaç
Mut: Kozlar (1450m), Göğden (1990m), Kırobası (Mara), Sertavul (1400m),
Anamur: Abanoz (1629 m), Sarıdana, Kaş (1600 m), Halkalı, Berem, Gözlügöl, Kayagöl, Akpınar (1634 m), Beşkuyu, Çukurbağ, Armutkırı (1400 m), Kayıhan, Elbalak (2000 m.), Tandır, Örcüölük (Everest 2001).

The soil types of Mersin

With the effect of climate, topography and plant vegetation, major soil groups have developed in the highplateaux in the following ways:

1. Colluvial soils: The accumulation soils on the sides of hills and deep valleys can be seen at different altitudes
2. Brown forest soils: Basic materials with high $CaCO_3$ content can be seen later Mersin-Tarsus Redzinal soil and continuous the boundary of Konya ,is separeted from the villages and have a high limestone content.
3. Non-limestone brown forest soils: On the serpentine, crystalline $CaCO_3$, under the forest and shrubs. Poor in $CaCO_3$ Brown soils: Vicinity of Adana: Tufanbeyli, Kahramanmaraş and Niğde are the boundary.
4. Red Mediterranean soils: From the northeast of Silifke extends north of Erdemli to the boundary of Konya and contains ferric ions (Fe^{+3}).
5. Red brown Meditteranean soils: the low altitude, and flat areas than from Red Mediterrainean soils on cement, crystal cancer, pebble materials develop (Köy Hizmetleri 1991).

Altitudinal variation in vegetation in Mersin

Maquis vegetation: *Ceratonia siliqua, Olea europea, Pistacia terebinthus, Arbutus andrachne, Rhamnus oleides, Quercus coccifera, Myrtus communis, Euphorbia macroclada, Laurus nobilis, Calycatome villosa, Paliurus spina-christii, Styrax officinalis, Phyllaria latifolia, Cistus creticus,*
Hygrophy vegetation: *Mentha, Tussilago, Parnasia, Clematis, Pulicaria, Veronica, Calamintha, Verbena, Vitex, Ranunculus spp.*
Edge of roads vegetation: *Papaver, Fumaria, Arabis, Nasturtium, Lepidium, Alyssum, Circium, Carduus, Echinops, Echium, Scolymu spp.*
Open areas: *Ajuga, Teucrium, Stachys, Salvia, Thymus, Ziziphora spp.*
Forest vegetation: *Juniperus excelsa, J. drupaceae*, *Cedrus libani, Abies cilicica, Pinus nigra, P. brutia*
Galery forest: *Salix, Populus, Platanus, Alnus spp.*
Grass vegetation: *Hypericum, Geranium, Erodium, Vicia, Trifolium, Bellis, Anthemis, Cichorium, Scorzonera, Taraxacum, Chondrilla, Myosotis, Anchusa, Galium, Rubia, Ornithagalum, Prunella, Muscari, Crocus, Allium spp.*
Rocky vegetation: *Umbilicus, Mathiola, Sedum, Onosma, Daphne, Primula, Cyclamen*
The high mount vegetation: *Cerastium, Dianthus, Helichyrsum, Cyperus spp.*

RESULTS AND DİSCUSSİON

In Alpine-Himalayan unit, the central and eastern Bolkars of Taurus Mountains are rich as endemics, while some of them, (eg. local endemic *Lamium garganicum* subsp. *pulchrum,*) live in and around Aslanköy. The others, such as *Alkanna aucherana*, *Stachys rupestris*, *Arisarum vulgare* and also *Alkanna kotschyana*, which has penetrated Mersin and Adana, grow among ruins near the seaside Mersin, Kızkalesi.

The total of 376 endemic plants such as *Lamium garganicum* subsp. *pulchrum* (Aslanköy), *Verbascum microcephalum* (Anamur: Akpınar), *Astragalus goeznensis* (Gözne), *Galium cilicicum* (Mut) and *Quercus petrea* subsp. *pinnatiloba*

(Balandız) are recorded from the Mersin region alone. Mersin shows about 20% endemism ratio in Taşeli plateau, Mut line and Bolkars of Middle Taurus Mountains. In this area, endemic trees such as *Amgdalus zielinskii, Quercus petrea* subsp. *pinnatiloba, Pyrus syriaca* and also flowering plants such as *Astragalus, Verbascum, Centaurea, Galium, Alyssum and Stachys* can be seen.

Meanwhile Mersin Research Herbariums records can preserve these endemic plants by Red List categories (Ekim *et al* 2000): LR (nt) 64 sp., LR (cd) 27 sp, LR (lc) 148 sp, VU 46 sp, EN 22 sp, DD 11 sp ve CR 5 sp. The categories given as not only endemic but also rare species were total of 5 of DD, 6 of VU and 1 EN (Ekim *et al* 2000). As rare species *Spinacia tetrandra DD, Halopeplis amplexicaulis* EN, *Astragalus drusorum* var. *maroniticus* VU, *Potentilla libatonica* DD, *Erica sicula* ssp. *libatonica VU, Stachys inflata VU, Calamintha betulifolia DD, Citrullus colocynthis VU, Gentiana brachyphylla* subsp. *favrotti DD, Potentilla libanotica DD, Zygophyllum album VU* and *Scilla silicica VU* are collected in Mersin.

Table 1: The general families which contain endemic species in Middle Taurus

Families	Bolkar mounts (Gemici 1994)	Mut-Silifke (Everest *et al* 2003)	Anamur-Gülnar (Özer and Everest 2008)	Sorgun-Erdemli (Yüceol *et al* 2009)
Lamiaceae	33	21	9	6
Fabaceae	35	6	3	3
Asteraceae	28	5	9	9
Brassicaceae	24	3	2	5
Scrophulariaceae	24	9	11	1
Caryophyllaceae	22	3	1	4
Apiaceae	16	1	3	2
Boraginaceae	12	9	2	1
Liliaceae	9	1	2	1
Rubiaceae	7	1	1	1
Campanulaceae	5	3	2	1
Hypericaceae	2	2	1	1
Total	1647 spp.	667 spp.	676 spp.	608 spp.

Table 2: The comparison of the some genera with other areas

Genera	Middle Taurus	Medit..Alps (Everest 2001)	Himalayas Dobremez *et al* 2000)
Astragalus	1.54	-	3.89
Veronica	1.54	-	3.89
Bromus	1.85	2.58	-
Euphorbia	1.39	2.58	3.61
Stachys	1.23	2.11	-
Centaurea	1.23	1.87	-
Campanula	1.23	3.75	-
Orchis	1.23	1.87	-
Geranium	1.23	3.52	1.55
Medicago	0.92	1.64	-
Thymus	0.77	2.81	-
Arenaria	0.61	-	3.68
Alyssum	0.61	-	0.99
Galium	0.61	1.87	1.55
Myosotis	0.46	1.64	-
Total	16.45	31.86	19.16

Table 3: The comparison of the families with other research areas

Mountains	end. (%)	Ast.	Poa.	Fab.	Brass.	Lam.	Car.	Ros.	Scr.	Api.	Lil.	Total spp.
Çakmak (Gümüş, 1992)	6.5	10.5	9.7	6.6	6.3	6.6	5.5	5.8	-	4.7	-	318
Tahir (Gümüş, 1992; 2007)	9	13.2	8.8	8.1	6.9	6.1	5.6	5.1	4.6	3.8	3.3	758
Hazar (Yurdakulol&Altan, 1984)	9.7	12.3	6	12.9	7.4	6.1	6.2	5	-	4.7	-	603
Süphan (Behçet, 1990)	8.7	15.6	9.2	10.3	7.2	6.9	5.1	4.2	3.5	4.4	3.2	780
Bağırbaba (Kaya, 1996)	6.5	11	7.7	9.5	7	8.3	4.8	4.8	2.9	3.6	-	862
Erek (Özçelik, 1987)	0.5	15.7	10.8	10	5	7.9	4.1	3.8	-	5	3	260
Munzur (Yıldırımlı, 1995)	19.9	12.1	5.0	8.7	9.2	7.2	5.7	-	4.0	4.2	4.3	1518
Middle Taurus (Table 1)	11	15	11.5	10.7	4	11.5	5.4	2.1	4.5	2.4	4.6	933
Medit. Alps (Everest 2001)	-	23	15	18.5	3.5	6.6	4.4	5	1	2	1.9	939
Himalayas Dobremez *et al* 2000)	-	15	11.8	9.3	4.3	4.9	4.1	6.5	4.6	-	2.4	8772

The Alps are famous for their rich and multi coloured flora, estimated in approx. 4500 different species: more than 500 are exclusive of the Alps, 180 species are endemic of the Western Alps and the other 70

species widely spread over the mountain range. Some areas of the Western Alps are rich in flora; in the Liguria and Maritime Alps 2660 different species accounting for 60 % of the French flora could be found (http://www.whc.unesco.org.).

The flora of the mountains of Central Asia, is a mix of Boreal, Siberian, Mongolian, Indo-Himalayan and Iranian elements. There are more than 5500 known species of vascular plants in the hotspots of which about 1500 are endemic while only Bolkars have 1710 endemics. Likewise, vegetation of Afganistan have 5000 species and 20-30 % of these species are endemics (Kaul 1997, Muratgeldiyev *et al* 2007, Ballabh *et al* 2007). *Juglans regia, Amgdalus communis, Cerasus mahalep* and *Pyrus, Prunus, Acer species* grow in the steppe and meadow zones of the mountains Tien Shan and Taurus.

Asiatic elements are maximum in Himalaya highplateaux however, there are also Irano-Turanien and Medditerenean elements such as *Alopecurus, Aegilops, Euphorbia, Orobanche, Cotoneaster, Bunium, Arnebia, Gagea and Alyssum.* The alpine meadow type is found in valley floors and hill slopes; these are *Polygonum, Carex, Anemone, Gentiana, Ranunculus, Potentilla, Elymus, Primula, Galium, Festuca, Poa, Stipa* which can appear together with steppic plants *such as Astragalus and Oxytropis*.

On the river sides, there are *Populus, Salix, Juglans, Fraxinus, Berberis, Pyrus* and *Acer.* Moreover, on valley floors with sand dunes, there are *Artemisia, Berberis, Ephedra, Origanum, Salicornia and Tamarix* shrubs. *Origanum, Achillea, Artemisia, Geranium, Euphorbia, Allium, Salvia, Clematis, Campanula* and *Silene* are common and widespread plants in Toluk valley (Everest and Türker 2009). As can be seen in the Polunin' s floristical list, *Asteraceae* and *Fabaceae* are principle families in Himalaya highplateaux, and other the most common families are *Orchidaceae, Lamiaceae, Brassicaceae, Liliaceae, Rosaceae* (Polunin 1999). However, these results are changeable due to the number of the collected materials. For example, *Asteraceae* and *Poaceae* are presented as an example of the principle families in the research of Savoie University (Dobremez et al, 2000). Also, it is possible to find some differences in the most of the genera in Polunin' s list.

As Allendorf pointed out that over 100 000 protected areas accounted for 12 % of the world's land area and these protected areas were seen as a key strategy to conserve diversity. If protected areas are to be conserved over the long term, management must address local residents' concerns and integrate them into management strategies (Allendorf 2007).

Generally, the main risk of the highplateux are pasturage and settlement, also cutting down trees and burning some schrubs. The subalpine and alpine zone of Central Alps has probably been changed by grazing which can be seen by the growth of such plants as *Mutellina, Scorzonera* and *Lotus* which are the indicators of this change (Meyer *et al* 2008).

Biological reserve areas of Middle Taurus, such as Çamlıyayla, Anamur, Gülnar and Erdemli highplateaus with forest and relic areas should be protected.

Environmental values of these highplateaus provide the clean water, wildlife and recreation activities. Natural and cultural values of these highplateaus provide not only economic benefits, but also quality of life values cherished by many.

In substance, MERA (Mersin University Research Herbarium), built in 1996, contains a total number of about 5000 plants. These plants symbolize the highplateaus.

The sample plants most similarly reflect the highplateaus of Mersin, as well as the Beşparmak Mountains of the Turkish Republic of Northern Cyprus, Nice Maritime Alps and Mediterranean region. And it contains a wide number of samples of the Alpine-Himalayan-Taurus Mountain range.

By gathering wide range of samples from both local and overseas travels, research projects and graduate theses, MERA has been formed in years. We hope that the introduction & presentation of this herbarium abroad, may be first realised.

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